SCIENTIFIC AMERICAN

[Entered at the Post Office of New York. N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION. ART. SCIENCE. MECHANICS. CHEMISTRY AND MANUFACTURES.

Vol. XLVI.—No. 15. [NEW SERIES.] NEW YORK, APRIL 15, 1882. [$3.20 per Annum. [POSTAGE PREPAID.]

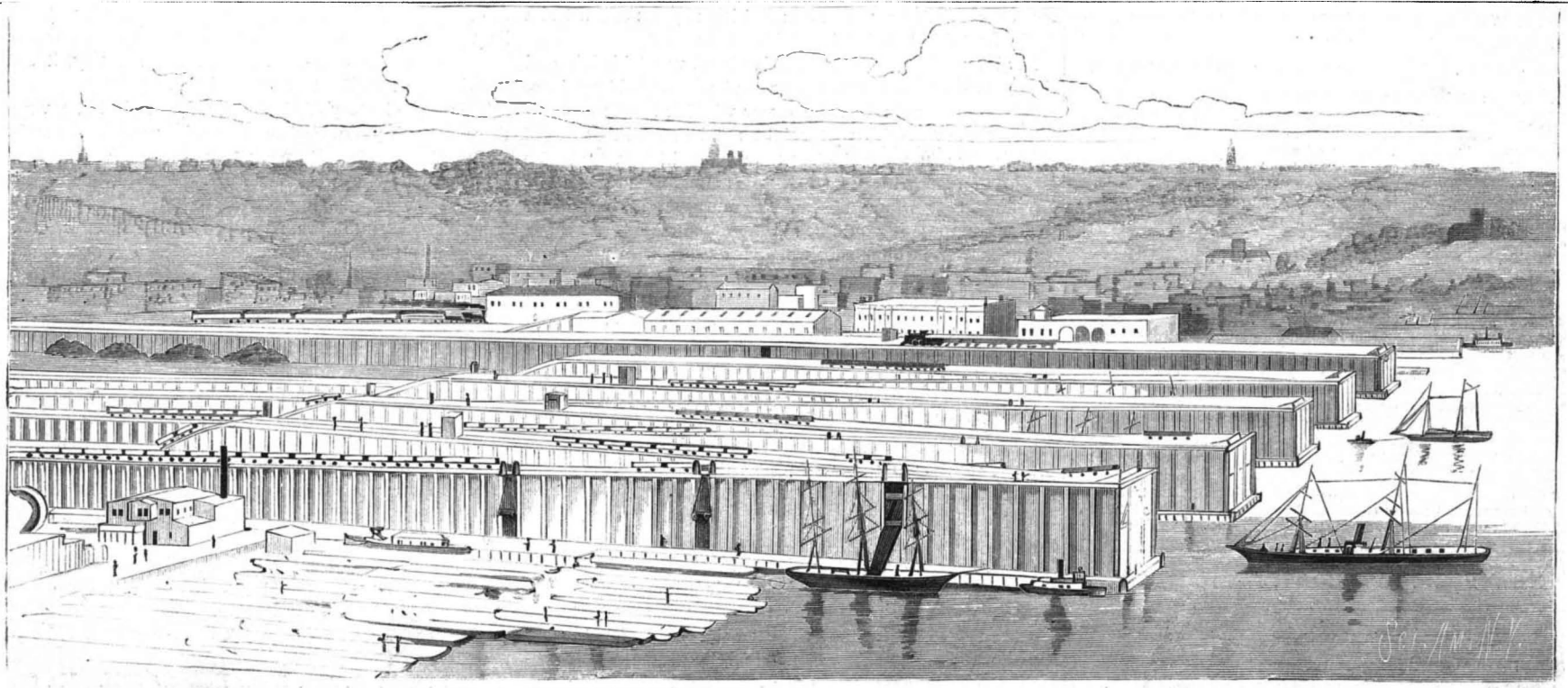

Fig. 1.—BIRD'S EYE VIEW OF COAL PIERS AND DOCKS HOBOKEN.

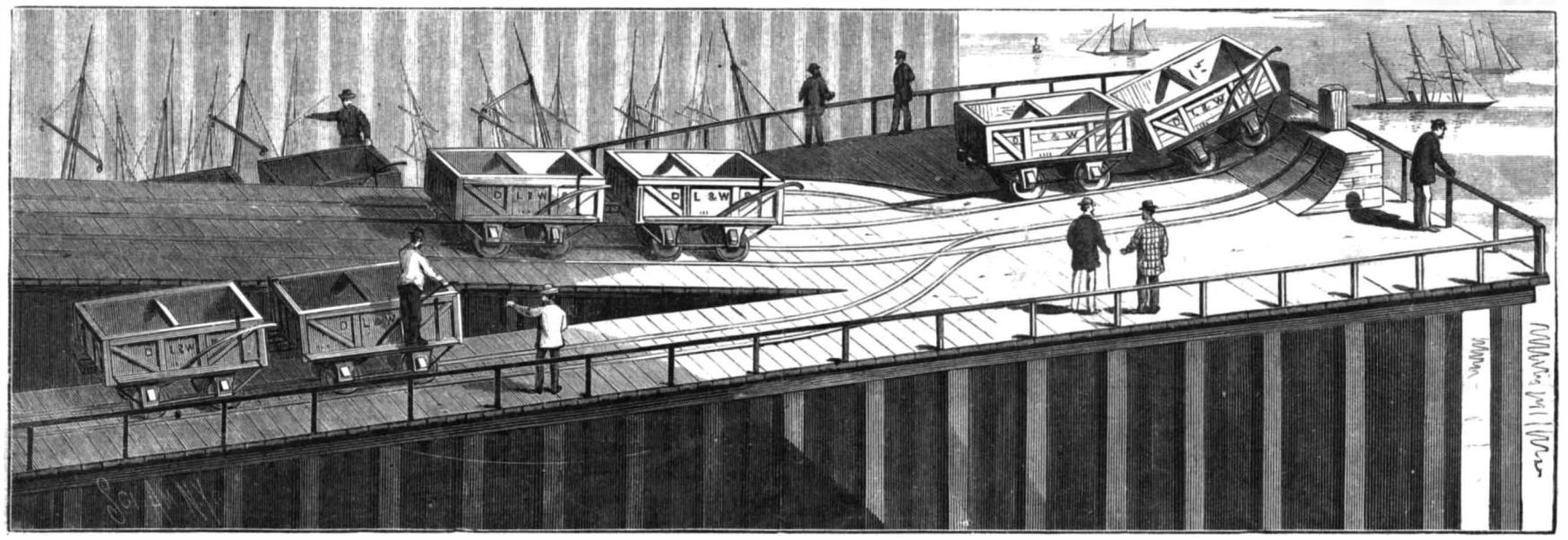

Fig. 7.—RETURN SWITCH, RIVER END OF THE PIER.

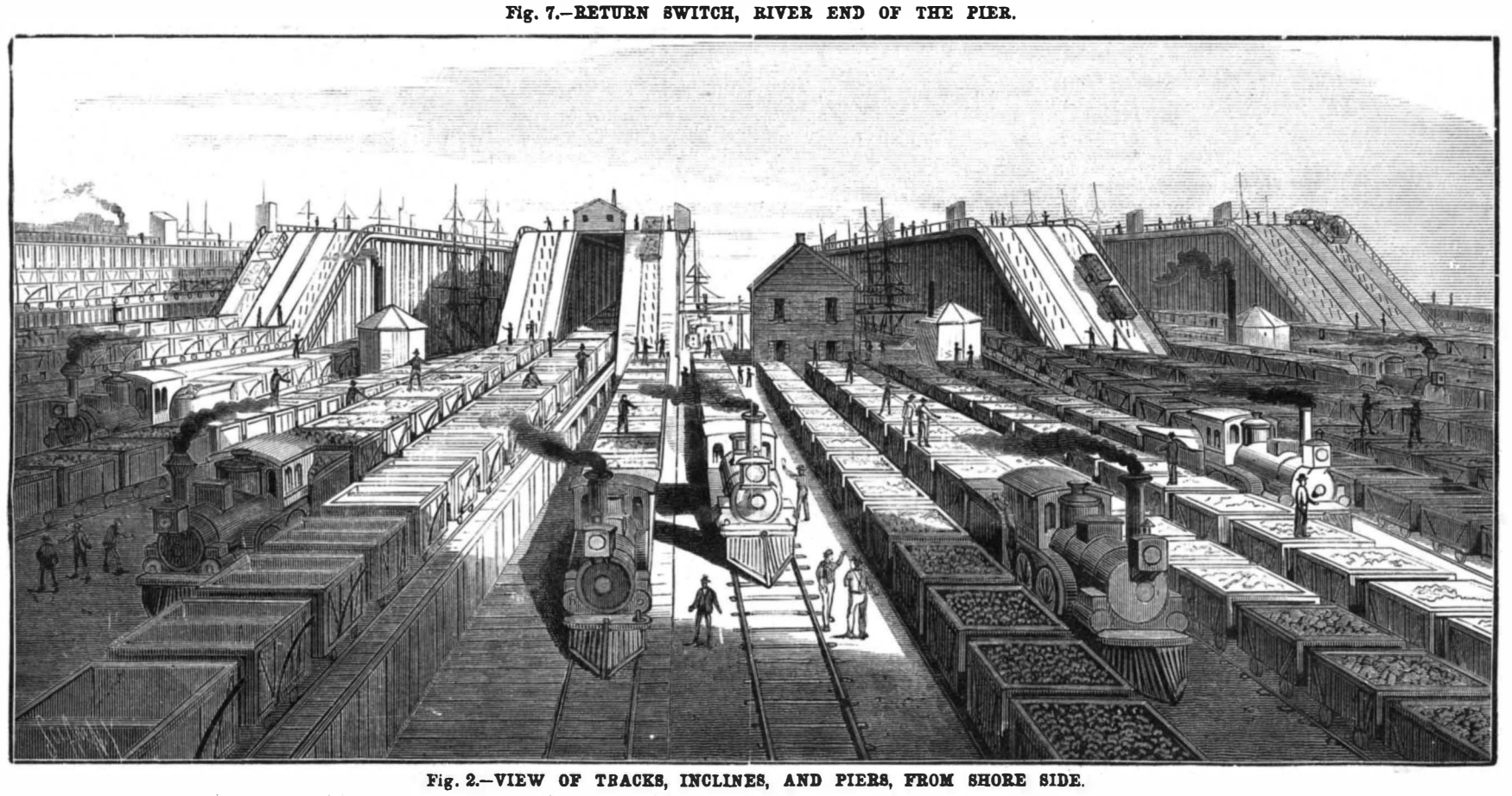

Fig. 2.—VIEW OF TRACKS, INCLINES, AND PIERS, FROM SHORE SIDE.

THE GRAVITY COAL PIERS OF THE DELAWARE, LACKAWANNA & WESTERN RAILROAD CO., HOBOKEN, N. J.

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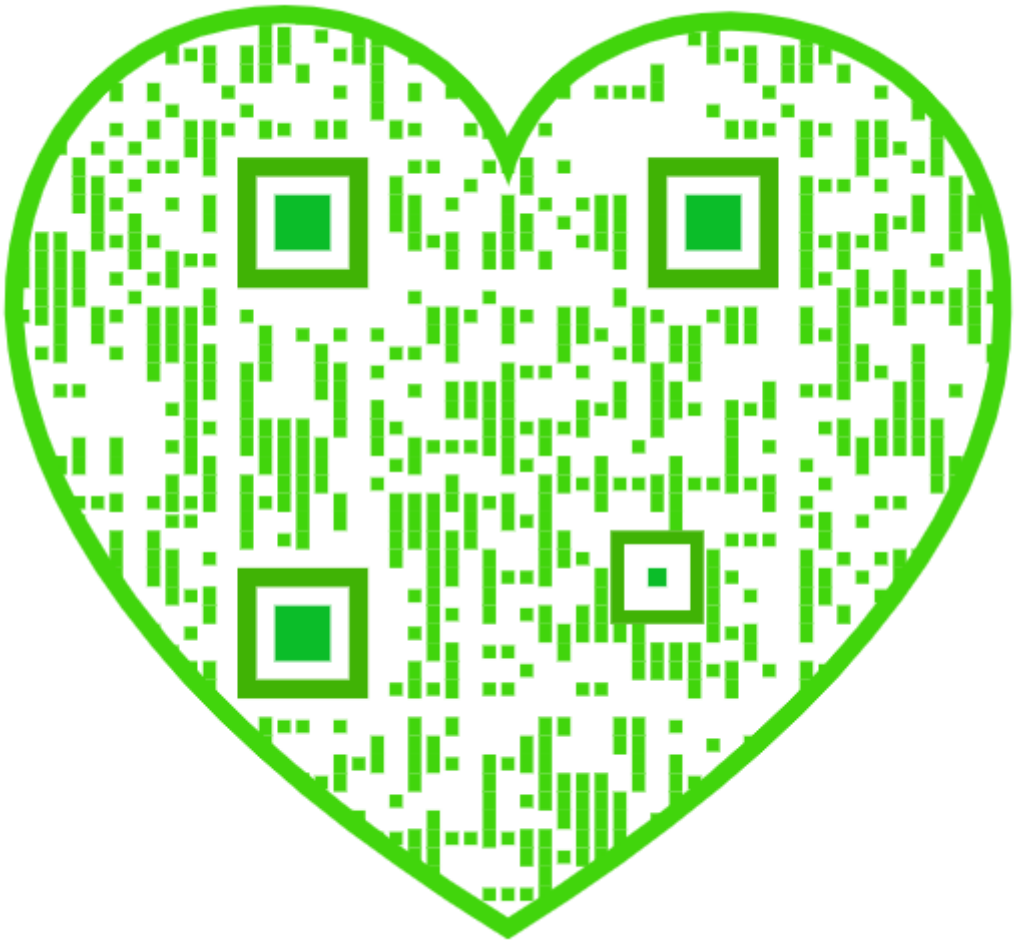

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, APRIL 15, 1882.

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A NEW FIELD FOR INVENTION.

A correspondent, writing from New South Wales, calls attention to a wide and promising field of invention which does not appear to have been much explored. In all parts of the world there are many noxious plants, which cultivators of the soil find it difficult or impossible to eradicate by the means now in use. In New South Wales, for instance, there are two plants, rather slow of growth, which have taken possession of many parts to such an extent that the clearing of the land would cost more than the land is worth, where land sells for $20 an acre.

The first, which flourishes in the warmer parts, is a cactus called the prickly pear; the other, which is confined to the cooler parts, is the English sweetbrier, the English wild rose thus proving as severe an affliction to parts of Australia as the Scotch thistle has in other regions.

In view of the similarity of animal and vegetable life, and the ease with which animal pests can be destroyed by poison, our correspondent raises the query whether some means of killing these vegetable pests might not be found that would be cheaper and more efficient than manual labor. "There is a lot of money to be made in this country," he says, "by anything that would answer the purpose; and in other places I suppose it would be still more valuable."

The matter is obviously worthy of thoughtful attention. If poison is used, it should be the inventor's aim to find one that would be fatal to the plant to be exterminated and yet harmless to other plants, or at least not such as to leave in the soil elements that would spoil it for future cultivation. Poisons that would injuriously affect the water supply for use by men, domestic animals, or fish, should be not less carefully avoided.

Obviously the best way to dispose of a plant that is so irrepressibly thrifty as to be a nuisance is to find some way to utilize it. Not a few of our most useful plants were once rank pests, owing to their persistent invasion of lands employed for other purposes. When a use has been discovered for their fiber or other properties, the thriftiness which made them a nuisance now only adds to their value.

If no use can be found for the pest, the next best step would seem to be to study the conditions of its local abundance, and correct them, if possible, by means which will make the soil more suitable for other uses. The charming sweetbrier of the English roadside causes no trouble there. Transplanted to New South Wales it finds conditions in the climate and soil, or a lack of vegetable competitors, which enable or allow it to flourish to a degree impossible at home. Most weeds are "exotics" of this class. It may be that in the cases named, and in others like them, some mineral, harmless or else useful to cultivated plants, placed about the roots of the plant to be eradicated, may put an end to its thriftiness or kill it outright. Failing in that, the inventor may find poisons which, while they destroy the plant pests, will themselves be destroyed or made inert by the juices of the plant they act on; or poisons which kill specific vegetable growths without injuring other useful plants or animals.

The field, as has been already noticed, is a wide one, and comparatively unworked. The values to be affected by successful inventions in it are enormous, and the inventions themselves could hardly fail to be remunerative.

COMET *a* 1882.

The first comet of the present year has been discovered. Mr. C. S. Wells, an assistant at the Dudley Observatory, Albany, was the fortunate finder, and there is a fair prospect that the celestial visitor will prove a brilliant member of the cometic family. The comet was picked up on the 18th of March, in the constellation Hercules. It had then a tail five minutes long, and a bright nucleus, shining like a star of the eighth magnitude. The tidings of the discovery quickly made its way over the civilized world, and the newcomer has been closely watched by practiced observers through the best telescopes, whenever the sky has been clear enough to permit a glimpse of its presence. It behaves much like other members of the same family under the same conditions, increasing in brightness, spreading out its gossamer train, and speeding swiftly on a course that every day brings it nearer to terrestrial territory. In the short time that has elapsed since its first appearance it has traveled many million miles through the blue depths of space, nearly doubled its light, and more than doubled its tail.

Astronomers are busy in watching its movements, noting its indications, computing its elements, and deducing from these premises an ephemeris that will be a guide to its present position in the sky, and a means of detecting by a comparison of orbits whether the mysterious stranger is an old friend renewing acquaintance or whether this is its first visit to the clime of the sun.

Mr S. C. Chandler, Jr., of the Harvard Observatory, has computed the elements, and an ephemeris of the comet, from observations made at Ann Arbor and Cambridge, which, however, can only be considered as approximate, until confirmed and strengthened by future observations. Professor Boss, of the Dudley Observatory, has made similar computations, his results differing considerably from those of Mr. Chandler. The medium of the two computations is probably a more reliable guide to the path of the comet.

Some interesting facts and possibilities may be deduced from the combined labors of the two brilliant astronomers who are first in the field.

Comet *a* is remarkable for its small perihelion distance. According to Mr. Chandler it will come within a hundred thousand miles of the sun, passing through the corona and perhaps grazing the photosphere. Mr. Boss estimates the distance at ten million miles, but both observers agree in prophesying a very near approach. Few instances are recorded of comets coming so near the sun. Those of 1880, 1843, and 1680 had nearly the same perihelion distance, but these dates are considered by many astronomers as marking repeated returns of the same comet.

The new comet makes its perihelion passage about the middle of June, and a magnificent display may be anticipated about that time. It is noteworthy for its great brilliancy under present conditions. It is now nearly two hundred million miles distant, and yet it has a bright, well defined nucleus, and a well developed tail. It is reasonable, therefore, to infer that it is a large comet, since it presents so brilliant an aspect at a distance so immense. As it is coming toward us at the rate of 2,000,000 miles a day, it cannot long remain invisible to the naked eye.

This is the history of Comet *a*, as far as it is known, but there is a rich promise of an entertaining visitor in our sky during the months of April, May, and June. The erratic stranger is moving westward and northward, having greatly changed its position since it was discovered. It has passed from Hercules into Lyra, within a few degrees of the brilliant Vega, has now reached the confines of Draco, and is making its way into Cepheus, where it will arrive some time in May, when it will make a sudden turn and seem to plunge headlong toward the sun, till it reaches that fearful proximity to the great luminary which is a groundless cause of anxiety in many minds.

Those who know the most about cometic astronomy are the least disturbed concerning any untoward accidents in its passage; and astronomers are looking forward to its close approach to the sun as a possible means of learning something concerning the physical structure of the huge globe of fire that is intimately and inseparably interwoven with the destiny of the human race.

The elements of the orbit of Comet *a* are thus given by Professor Boss: Time of perihelion passage, June 15; longitude of perihelion, 49° 35′; longitude of node, 206° 39′; inclination, 74° 47′; perihelion distance about ten million miles.

April 14, R. A. 18h. 50m., Dec. 51° 9′ N. Mr. Chandler's computations give: Longitude of perihelion, 62° 30′; longitude of node, 200° 11′; inclination, 70° 51′.

As the comet approaches nearer the earth other astronomers will doubtless map its course, and repeated observations will modify results. Even if the figures are at fault in minute particulars, there is every reason to expect that a comet of grand and awe-inspiring proportions will in the coming months span the heavens with its gossamer train; that there will be intense excitement in watching its near approach to the sun; that it will be observed and studied as comet was never observed and studied before; and that unless men of science are greatly mistaken, it will take rank with the distinguished comets of 1811, 1843, 1858, 1861, and 1880 on the cometic annals of the nineteenth century.

FISH CULTURE IN AMERICA.

The eleventh annual meeting of the American Fish Cultural Association began in this city April 3. A large number of the more active State and national Fish Commissioners and other friends of fish and fishing were present.

The meeting was called to order by the Vice-President, Mr. George S. Page, of this city, who gave a most encouraging account of the success which had attended the artificial propagation of trout, shad, and black bass.

The Secretary, Mr. Barnet Phillips, read a paper by Mr. H. D. McGovern, of Brooklyn, on the habits, endurance, and growth of the carp. He advised the putting of a few carp in trout ponds to keep the ponds clean.

Assistant United States Commissioner Mather read an interesting paper on a remarkable development of embryo salmon. It had been his belief that the absorption of the sac was necessary for the complete development of the young fish, but he had been convinced of the contrary by an accident which happened in a newly constructed hatchery at Roslyn, L. I. The imperfect tarring of one of the troughs caused a liver disease in the young fish, leading to a casting off of the sac; but when placed in another trough the fish lived, took food, and developed naturally. The cause of the trouble he suspected to have been turpentine absorbed by the water from the exposed and freshly cut pine boards of the trough. Once before he lost a lot of young California salmon by hatching them in an oaken trough, the tannin of which perceptibly impregnated the water. These experiences led him to consider the cause of the extinction of trout below sawmills. He said:

"The theory of the fishermen near sawmills is that sawdust gets into the gills of trout and kills them. This may be true to some extent, but I doubt it, for the reason that sand or other material does not appear to injure the gills, and I have taken adult trout below sawmills. I am inclined to think that the mills are destructive merely to the young by covering the spawning beds to some extent, but more by the absorption of turpentine from the pine or tannin from the oak, the evil effects of which we know too well."

Commissioner McDonald, of Virginia, described a successful method of transporting impregnated eggs to long distances, their development being retarded by reduction of temperature.

Mr. Blackford spoke of the recent shipment of 14,000,000

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codeggs from New York to Washington, and said that it was intended to have the steamer Fish Hawk, with its appliances for hatching, sent here, and offered, if this was done, to furnish 100,000,000 eggs per diem for hatching purposes. This could easily be done, in his opinion, as a large cod will strip 9,000,000 good eggs. This method will save the expense of sending out a special steamer to catch fish with ripe eggs, and will save a great waste of both fish and eggs.

Professor C. W. Smiley, of the Smithsonian Institution, read an important paper comparing the statistics gathered by the United States Commission in 1871 and those gathered in 1879 for the census statistics. The total number of pounds catch reported in 1872, with four large points wanting, was 42,350,000 pounds. Making a fair estimate for missing ports, the total catch was 50,000,000 pounds, During the year 1879 the total catch was 68,742,000 pounds, which was probably smaller than in the intervening years. The greatest decline in the catches was shown in returns from the ports of Buffalo and Cleveland, and the greatest increase in the returns at Chicago, where, in 1872, the catch marketed was 7,462,150 pounds, and in 1879, 17,247,570 pounds. As fishermen have more effective apparatus for capture than formerly, and the lakes are more thoroughly and exhaustively fished than before, the slight increase in the catch during the decade virtually means a decrease in the quantity of fish, and that a gradual depopulation is following the introduction of small meshed nets and the use of steamers. In support of this theory Prof. Smiley gave a large number of statistics showing the gradual but certain extermination of the whitefish and salmon trout. This was due in part to the fact that there were enough nets used in Lake Michigan alone to reach, if stretched in a continuous line, from one end of the lake to the other. The whitefish now caught are rarely ever large enough to rate higher than No. 3, and no fish large enough to rate as Nos. 1 and 2 are ever caught. Old fishing places once fairly alive with fish are now exhausted and deserted by the fishermen to superannuated Indians and gulls. Another cause for the disappearance of the fish is the prevalence of quantities of sawdust near the mouths of rivers, which destroys the fish. In Lake Erie, though whitefish and trout have decreased, the quantity of bass, pike, and sisco has increased since alewives were introduced.

The Secretary read a paper by Seth Green on the hatching of sturgeon and striped bass, in which he insisted that the artificial propagation of these fish was necessary to keep them from extermination. The chief enemy to the sturgeon is the eel, which, when the female sturgeon is ripe and ready to deposit her spawn, often enters the vent and remains there until it has stripped her of all her ova. As a remedy against this evil he recommends the placing of the fish in a car, and placing about it a harness of some kind that will prevent the eel from entering her and destroying the spawn. With such apparatus and properly protected waters in which to further breeding, he is of opinion that sturgeon may be successfully propagated. He has succeeded in hatching out in his shad-hatching boxes 155,000 sturgeon fry, which experiment he offered in proof of his claim. The striped bass he thinks can, by the use of racks or slides, be caught in a sufficiently ripe condition for use in artificial propagation in Southern waters.

Mr. Blackford read a letter from S. M. Johnson, of Boston, urging the more strenuous enforcement of the laws against the sale of small lobsters; and a resolution was adopted instructing the officers of the association to forward to Albany a request for an increase of the number of game constables for the purpose.

The Secretary read a paper by Prof. John A. Ryder on oysters, treating particularly of the possibilities and probabilities of the artificial propagation of this toothsome bivalve. The view taken was not hopeful, as the methods employed had failed to keep an embryo oyster alive more than a week. The trouble seems to be that the experimenters are working on an entirely impractical plan, based on an erroneous theory as to the conditions of the problem.

The migration of shad, the recurring failure of the Canadian salmon fisheries, the food value of the sword fish, and kindred topics were among the other subjects discussed.

The officers elected for the ensuing year are: President—George Shepard Page, New York; Vice President—James Benkard, New York; Treasurer—Eugene G. Blackford, New York; Corresponding Secretary—Barnet Phillips, Brooklyn; Recording Secretary—James Annin, Jr., Caledonia, N. Y.; Executive Committee—Fred Mather, New York city; G. Brown Goode, Washington, D. C.; Seth Weeks, Pennsylvania; Benjamin W. West, New York city; T. B. Ferguson, Washington, D. C.; C. B. Evarts, Vermont; and William M. Hudson, Connecticut.

The association adjourned to meet in Boston on the first Wednesday and Thursday of September next, at which time an effort will be made to have Prof. Baird call a meeting of the Fish Commissioners of all the States in the Union to meet in conjunction with the fish culturists.

LOCOMOTIVES AND MALARIA.

Dr. Wm. S. King, Surgeon United States Army, claims that the frequent movement of railway trains tends to diminish or prevent malarial diseases in localities where all the necessary conditions for the development of malarial effects seem to be present. His theory is that the heated locomotives, by continually passing through the infected districts, rarefy the air, and create a constant atmospheric disturbance by inducing warm upward currents, such currents acting, with the pure air which rushes in from all directions, as agents in the dispersion or annihilation of the miasmatic influence.

Dr. King's theory would appear to be based upon information received in West Philadelphia while selecting a place of residence for his family in a locality adjacent to the Schuylkill River, where, notwithstanding the nearness of low lands, the residents claimed to enjoy immunity from malarial affections.

It is popularly believed that there are many places where the same profession is made by residents and land agents, and yet new-comers are apt to have their confidence in the value of interested testimony severely shaken out of them in the course of a year or two.

Perhaps a more extended observation of railway centers may lead Dr. King to modify his theory. The atmosphere of the lower levels of Jersey City, for example, is agitated by passing trains to a degree perhaps unrivaled in any corresponding area; yet, to speak within bounds, malarial diseases are not unknown on that side of the river; nor do our sanitary authorities report any signal diminution of malarial troubles among the residents of Harlem flats since steam roads were put upon the avenues and locomotives began to stir the air incessantly.

The circumstance that locomotive engineers and firemen are not exempt from ague and other malarial afflictions may not militate against Dr. King's theory, for trainmen do not spend quite all their time on the road; but how would he explain the fact that the extension of malarial diseases, their invasion of new districts, is so apt to be along the lines of railways? Is it because the trains on new roads do not run with sufficient frequency?

M. Poitevin.

Louis Alphonse Poitevin was born at Conflans, in the department of the Sarthe, in 1819. The earlier portion of his education was obtained at the neighboring town of St. Calais, whence he proceeded to the *Ecole Centrale* in Paris. During his course in this establishment he devoted himself almost entirely to chemistry and mechanical studies, and passed out of the school in 1843 with the diploma of civil engineer. His first official appointment was that of chemist to the *Salines National de l'Est*, in which capacity he introduced many improvements in the manufacture of salt, while his mechanical knowledge enabled him also to introduce new forms of apparatus and machinery, he also made improvements in the processes of manufacture of bleaching powder (hypochlorite of lime), salts of potash, magnesia, as well as sulphuric acid.

When photography came upon the world as a scientific curiosity Poitevin's *penchant* for chemistry led him to experiment in this new direction, and we find him in 1848 publishing the fact that it was possible to produce an electro deposit of copper upon the whites of the daguerreotype image. His experiments in this direction led to the discovery of a method of photo-chemical engraving upon metallic plates coated with silver or gold, for which he received the silver medal of the *Société d'Encouragement des Arts.*

Subsequent to this he turned his attention to the study of the action of light upon bichromated gelatine, in which principle he recognized the possibilities of great achievements. He first applied himself to the production of moulds in relief, and patented, in 1855, his helio-plastic process—a description of which is to be found in our volume for that year. This consisted simply in preparing a film of gelatine of greater or less thickness according to the depth of the relief required, which, after sensitizing by means of potassium bichromate, was exposed to light under a negative. It was subsequently treated with cold water, when the portions unacted on by light swelled up and so formed an image in relief, from which a mould in plaster or other suitable material could be taken.

His next achievement was the fatty ink process, of which he may be said to have been the father. This was based upon his discovery that the surface of the bichromated gelatine film after exposure to light became repellent of water, though it permitted a greasy ink to adhere; and in 1855 or 1856 he established an *atelier* for working this and the photolithographic processes. This venture did not, however, prove a great success, and he was compelled to relinquish it to M. Lemercier, who, with various modern improvements and extensions, still carries on the establishment.

In 1862, having for some time past devoted his attention to the so called carbon process, he published his new method of printing upon paper in pigmented gelatine, and this method no doubt forms the starting point of the now perfected process of carbon printing, or autotype. For this and his labors in connection with photolithography he was awarded the prize offered by the Duc de Luynes. He also published researches in connection with the action of light upon various salts of iron, and devised the first "dusting-on" process, which was based upon the hygroscopic properties of a mixture of tartaric acid and perchloride of iron.

At the Paris Exposition Internationale of 1878, M. Poitevin was named *Callaborateur Universal,* and was adjudged an honorarium of 7,000 francs and a gold medal in recognition of his services in the advancement of photography. This sum was, however, never paid.

For many years past M. Poitevin had retired from active participation in the advancement of photography, though he still retained his interest in that as well as other branches of chemistry and science. Having settled at his native place, Conflans, he preferred to spend his latter days in that leisure which his active life so justly entitled him to; and it was there he passed away, March 4, 1882, mourned by a large circle of affectionate relatives. His death removes from the ranks of photography one of the few remaining historic names.—*Brit. Jour. of Photography.*

FOODS FOR INFANTS AND INVALIDS.

It may be questioned whether there is any subject which comes more closely home to people of all classes than the character of the food supplies specially provided for infants and invalids. The increasing demand for this class of preparations (due partly to an actual need, but chiefly, we suspect, to the skillful advertising of manufacturers and the liberal margin of profit they offer to the retail trade), has led to a great number and variety of such competitors for public favor. Put up in ornamental boxes, they appear on the counters of every grocer and in the show cases of every apothecary shop; and not unfrequently their actual value is in inverse ratio to the pretentiousness of the package and the price.

As a rule, purchasers are obliged to take the virtue of such articles upon trust, few having the means or the knowledge requisite for an analysis, microscopic or chemical, of the preparations which they are advised to try, perhaps by the family physician, and yet a mistake in this connection may be fatal.

For all young infants, and for adults in many cases of sickness, starch food is injurious: sometimes in being a source of intestinal irritation; sometimes, as in the case of very young children, in furnishing a semblance of aliment without the reality, such children being as unable to digest and assimilate starch as sand. Hence the usual claim with respect to prepared foods of the cereal class is that they are free from or contain very little starch, while they are rich in gluten and other food elements capable of nourishing the sick and the young. To discover how far these claims are well founded, Dr. Ephraim Cutter, of Harvard College and the University of Pennsylvania, has lately made microscopic examinations of something like forty cereal foods, developing facts of the highest importance to physicians and their patients as well as to parents having young children. The results of his investigation appear, with numerous illustrations, in the SUPPLEMENT for this week. The article (which, by courtesy of Dr. E. S. Gaillard, we reprint from the *American Medical Weekly*) is worthy of study by all who are interested in microscopy or in the nourishment of invalids and children.

A Precocious Picklock.

On April 5 a twelve year old black boy, named Coleman, was brought before the United States Commissioner at Baltimore, Md., charged with robbing the private letter boxes in the city post office.

The locks on these boxes are of a kind supposed to be proof against picking, and the authorities could not believe the little rascal's admission of guilt. So the marshal of police and the assistant postmaster took the little fellow to the post office, where he gave them an exhibition of his skill in opening burglar-proof locks. He had a little strip of wrought iron which he had hammered very thin, and, putting this in the keyhole of a box and giving it one or two slight taps with his finger, open flew the box as if by magic. Box after box he opened in the same way.

Among locksmiths of Baltimore the case has excited, it is said, the widest interest, and the discovery that these locks can be picked may lead to an entire change in them. Government experts are already studying the case. The boy Coleman was sent to jail by the commissioner to await the action of the grand jury on his case.

Now would appear to be a good time for some inventor to bring out an unpickable lock suitable for post office use.

SIR CHARLES WYVILLE THOMSON died on the 12th of March, at the age of fifty-two. He was born at Bonsyde, Linlithgowshire, on the 5th of March, 1830. His exploring expeditions in the Lightning, Porcupine, and Challenger, in which the "depths of the sea" in the Atlantic and around the world were investigated with remarkable success and multitudes of new discoveries, have made his name familiar to the people of all civilized lands. The publications of his last expedition are still in progress. After graduating at the University of Edinburgh, he was appointed, in 1850, Lecturer on Botany in King's College, Aberdeen, and, in 1870, Regius Professor of Natural History in the University of Edinburgh. His so early departure is greatly to be deplored.

The Tobacco Plug Patent Declared Invalid.

The United States Circuit Court of Kentucky, Judge Baxter presiding, has declared invalid the reissued patent of Miller & Worley, 8,060, January 29, 1878. This patent was for the idea of stamping letters or other marks by pressure into the side of the plug of tobacco. Instead of the usual plain plug, the inventor produced a plug marked with the maker's stamp or other ornamentation. This patent was considered to be of great value; but the court declares it to be invalid on the ground that Miller was not the original and first inventor. The testimony showed that Edward F. Smith invented and worked the same thing in 1875.

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Heavy Keel for a Small Yacht.

A thirty-three ton lead keel was cast, March 30, by Mr. Henry Pipegras, of Brooklyn, for a cutter which he is building for Mr. Archibald Rogers, of the Seawanhaka Yacht Club. The heaviest keel previously cast in this country was for the cutter Oriva, and weighed twelve tons. The heaviest cast in England is said to be that of the sloop Valkyr, weighing twenty-four tons.

The casting of the keel was performed in the following manner: The oak keel was turned upside down, and a wooden mould constructed upon it of the exact size and shape of the proposed keel of lead. Then two furnaces of brick were constructed alongside of it, which sustained the pots in which the lead was melted, these pots being sufficiently elevated to allow the lead to flow from their bottoms into the mould. The two pots were needed in this instance, because of a doubt whether the melted lead would flow freely for the full length of the mould, about thirty-five feet. It is necessary that the melted lead shall be only raised to a temperature high enough to permit of its free flow, as, if it is made too hot, there is danger of its burning the wood. It was therefore necessary, after liquefying the first lead thrown into the pots, to cool the mass by constantly adding pigs of solid lead. The desired shape being that of a rocker, the ends of the mould would of course fill first, and unless restrained would overflow. Men were stationed along the whole length of the proposed keel, with pieces of heavy plank, ready to spike them on as soon as the lead reached the top of the mould. So promptly was this done that scarcely a particle of the molten metal overflowed until the extreme top of the arch was reached and filled. Mr. Pipegras will soon cast the keel of another cutter, to weigh twenty-one tons. In casting keels heretofore the bolts were first placed in position through the wooden keel, and the lead run in around them, but it was found that, as the lead cooled, it shrank away from the bolts and made the job an imperfect one. The plan followed by Mr. Pipegras is to bore the holes for the bolts through wood and lead together after the casting; then to drive the bolts and secure them with nuts and plates on top of the keel. The keel is then turned over and the work of fitting the frames goes on.

An Arctic Ocean Cable.

The project of connecting Europe and America by telegraph cables passing over Greenland, Iceland, and the Färöe Islands, entertained as far back as 1853, is again revived. At a recent meeting of the Danish Geographical Society, Mr. E. L. Madsen, an eminent telegraph statistician, read an interesting paper on the subject. The scheme of Mr. Madsen differs from that devised by Colonel Taliaferro P. Shaffner, who was the first to propose a North Atlantic cable, inasmuch as the line from the Färöe Islands to Norway was abandoned, the far shorter and more important line to Scotland, and another from Scotland to Norway, being substituted. Further, he would use almost exclusively submarine cables, while Shaffner in his plan included as many overland lines as possible. The essential reasons for avoiding long overland lines were the difficulty in keeping them in working order in the desert and impassable regions of Labrador, Iceland, and the Färöe Islands, and again the frequent appearance of the aurora borealis. Mr. Madsen explained that his landing places were selected so as to protect the cable against the waves of the ocean. At Iceland he would land it twenty miles south of Reykjavik, running it underground to that city. Thence it is to go south of Cape Farewell to Julianshope, Greenland. Quebec would be the American terminus of the North Atlantic cable, whence connections would be established with all American telegraph lines.

MISCELLANEOUS INVENTIONS.

A novel cattle car, patented by Mr. John G. Klett, of Brooklyn, N. Y., is provided with standards on which gates are hung, having at the top and bottom spring latches fitting in apertures in the top and bottom of the car, whereby the gates can be locked at any desired inclination to form stalls for the animals. The standards are connected by transverse bars carrying hay racks and a water pipe, and also carrying longitudinal rails on which troughs slide.

Mr. Martin Sedlacek, of Troy, Mo., has patented an improvement in riding saddletrees. This saddletree is made of two or more thicknesses of leather moulded into the form of a saddle and secured together, and provided with the front stay, inserted and secured between the layers of the leather.

A novel double acting bellows for milk aerators has been patented by Mr. Norman G. Stebbins, of Rome, N. Y. This is a device by means of which a continuous current of air may be forced into and through a body of milk for cooling the milk and for driving off the animal odors. The invention consists of double-acting bellows formed with a chambered central partition, into which, through valved openings, air from both chambers of the bellows is forced, and from thence, through a suitable conduit, into the body of the milk.

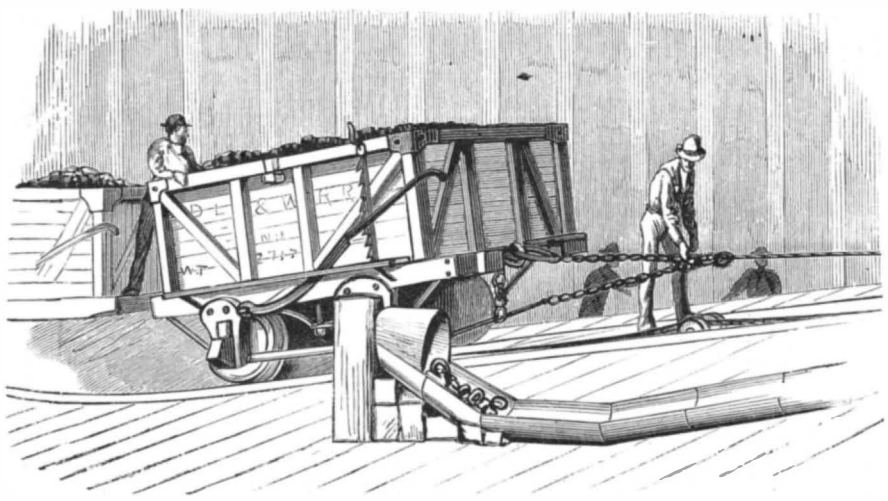
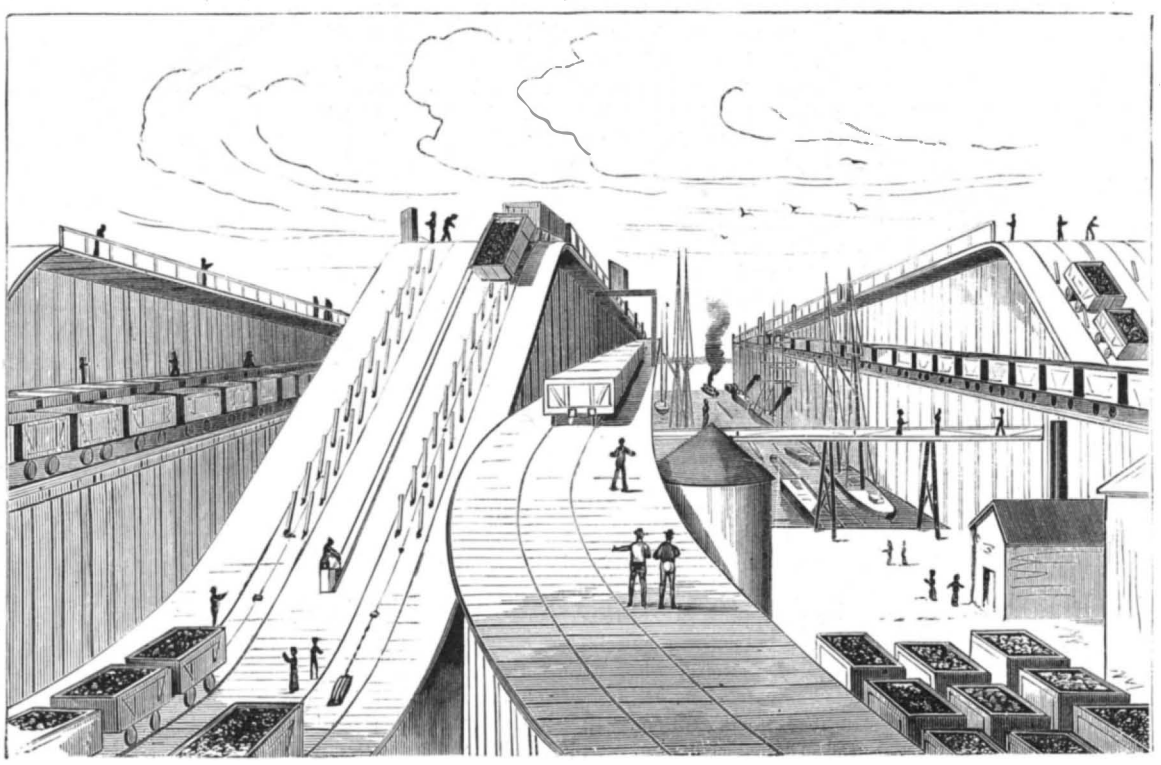


Fig. 4.—CONNECTING WITH THE CABLE SYSTEM.

A combined blacking-box holder and foot rest has been patented by Mr. Jacob Rees, of Cleveland, Ohio. This invention consists in hinging the blacking-box holder under the foot rest, and in constructing the foot rest and cover of the box holder, and combining the same in such manner that the cover will be automatically opened and closed upon the withdrawal of the box holder from and returning it under the foot rest.

An improvement in ornamental chains has been patented by Mr. Salomon Davidson, of New York city. This invention relates to links of ornamental chains, which have heretofore been made by the combination of interlaced rings or loops covered by tubing and bands of ornamental character, the general object of such construction being to dispense with the use of solder for connecting the parts. This invention consists in a cap or band applied as a finish or ornament to the ends of the links and retained in place by a shoulder on the cap.



REAR VIEW OF PIERS.—RETURN INCLINE.

Mr. William H. Ertell, of New York city, has patented a portable trunk rack, with which a trunk can be readily moved from one room to another, however large and heavy the trunk may be. With it there is no danger of injuring the carpet or floor; when desired it may be adapted to be used as a table by simply removing the trunk and placing the center piece or top in the space formerly occupied by the trunk.

An improved draught equalizer has been patented by Mr. Joseph M. Langston, of Waverly, Ill. The invention consists principally of intermediate bars pivoted centrally upon the ends of the main doubletree, to the inner ends of which the lead-horses are to be attached by means of a rod or suitable chains, the wheel-horses being attached to the outer ends of the bars.

THE GRAVITY COAL PIERS AT HOBOKEN.

Among the peculiar conditions of the enormous traffic in coal carried on at this port there are two which are chiefly instrumental in determining how the work must be done.

The quantity of the material delivered in any unit of time is comparatively very great; and the value of the coal, compared in bulk or weight with other commodities, is very small. Hence the necessity of employing broad, cheap, and rapid methods of handling large quantities at once, with the least outlay of mechanical power and manual skill.

A typical illustration of the means which have been devised for meeting the larger necessities of this great traffic may be found in the docks and piers of the Delaware, Lackawanna, and Western Railroad Co., at Hoboken. This corporation, as our readers are aware, is one of the half dozen great coal mining and transporting companies of the country. The Eastern or New York terminus of its road lies just south of Ferry street, Hoboken, occupying a large block of the made land which covers what was once a broad shallow bay between the Hoboken ferry landing and the slips of Jersey City ferry. The property outside the old shore line comprises eighty-five acres, and is divided about midway by a basin or dock, running back to near the line of the original shore, something over half a mile from the present river front. South of this basin lie the tracks, piers, wharves, and docks used in the coal traffic. A fair idea of the extent of these appliances for the delivery of coal may be obtained from an inspection of the larger illustrations herewith. The method of handling the coal, or, to speak more exactly, of delivering it without handling it, will need perhaps a more extended description. Standing at the point of view of Fig. 2, and looking riverward over the sea of coal cars, some full, some empty; some moving, some at rest; and, whether rolling toward the delivery piers or returning empty, nearly all pursuing their course unattended and for the most part without visible means of propulsion, it is hard to realize that the vast movement is under perfect control, and with all its seeming complication is in reality very simple.

A little closer inspection will discover that the grade of all the tracks carrying loaded cars descends slightly toward the river, so that the long trains are, as it were, eagerly pushing riverward for deliverance, urged on by their own gravity. At the further end of the line car after car is seen to leave the press and (still without visible means of propulsion) to climb the steep grade to the top of the elevated pier and then roll forward along the higher level to the point of discharge.

We change our point of view to the foot of the slope. Here we find a weighing shed and an engine house, in which is a stationary engine operating a cable system by means of which the cars are hauled one by one up the slope to the top of the pier. The hitching of the car to the cable, and, after weighing, its passage up the slope, are shown in Figs. 3, 4, and 5.

We climb to the top of the pier, some sixty feet or so above the water. The pier carries four tracks, two descending at a slight grade toward the river end of the pier; and other two (for the return of empty cars shoreward) descending from the river end toward the original starting point over half a mile inland, the viaducts for return passing at an easy grade far to the rear of the foot of the more steeply ascending slopes.

From the top of the ascending slope the pier extends a thousand feet into the Hudson, flanked on both sides by docks, in each of which float a varied fleet of canal boats, barges, schooners, square rigged vessels, and other shipping, receiving coal or waiting their turn to haul alongside the delivering chutes for the reception of a cargo. From forty to fifty vessels find berth room in each of the docks between the five coal wharves, and perhaps as many as in all of them together in the long basin first mentioned.

As soon as a place is vacant at one of the chutes the brakes are loosened on three or four cars, and they move forward, as of their own volition, to the openings over the place of discharge, where they are arrested by an application of the brakes. The car has scarcely come to rest before two workmen attack the lock which holds its movable bottom in place. A sharp blow or two upon the fastening, a turn of a wrench, and the halves of the car bottom fall apart like two hinged doors, and the coal drops into the screening box leading to the iron chute which projects at a low angle from

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the side of the pier over the open hold or the hatchway of the vessel to be filled. At the lower end of the chute a man stands holding the end of a plank which serves as a cut-off to regulate the flow of coal by arresting its motion, so that it will fall regularly, neither overshooting its mark nor entering the hold with a momentum likely to do injury to the vessel's side or bottom. The empty car is at once set in order for the return trip, the bottom valves are closed and locked, the brakes are freed, and the car is turned over to the care of gravity to complete its circuit, guided to the right track by an automatic switch at the river end of the pier. The operation of this switch is shown in Fig. 7. At the extreme end of the pier the track rises to a buffer with a steep upward curve, which arrests the momentum which the car has acquired in running down the grade from the chute, and shifts its line of trend so that it takes the return track either at the side of the pier or in the middle, as the arrangement of tracks may determine.

By this gravity system, from the time a car enters the yard loaded until it stands in line with its empty associates ready to be joined to a train returning to the mines, its circuit of a mile or more calls for human intervention only where it is attached to the cable to be hauled up the slope, and at the delivery chute where its load is almost automatically discharged. At every other point it moves unattended, rolling on a down grade by its own weight. On each side of each pier there are provided perhaps half a dozen chutes whereat vessels may be simultaneously taking in coal. Each pier has thus a capacity for discharging four hundred car loads of coal a day, or two thousand car loads may be delivered at all five piers; this with a working force, men and engines, that would be entirely inadequate by any other system.

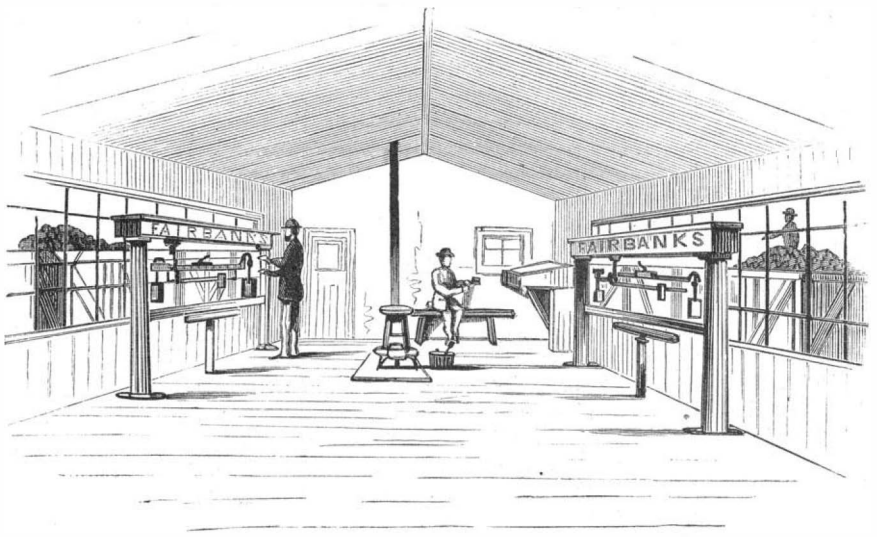


Fig. 3.—IN THE WEIGHING ROOM.

A New Steel Process.

Among the various attempts which have been made to improve on the Bessemer process, not the least noteworthy was the idea of using a fixed converter. Such a converter would permit the slag to be run off at an early stage in the blow, by which many advantages might be gained. Hitherto it has been found impossible to prevent the metal from escaping through the tuyeres.

A patent has been taken out by Mr. Griffiths which promises to get over this difficulty. A trial took place on Friday last at the works of Messrs. Nurse, Redbrook, Monmouth, with a small low pressure fixed upright converter capable of holding about one ton; in the presence of some of the leading iron and tin plate manufacturers of South Wales and Staffordshire. Blows were made with a maximum blast pressure of 4½ lb. per square inch, each blow taking only an average of twenty minutes. The yields were good, and the steel produced appears to be of excellent quality, soft and ductile. We have not yet tested its tensile strength, but this we hope to do in a few days. Some of the steel was worked and welded in the presence of those present. We may mention that previous to this trial some twenty blows had been made, the steel of which had all been worked into bars, sheets, and tin plates. No spiegeleisen has been used, the only addition being a little over 1 per cent of ferro-manganese. The advantages claimed by the patentee for the process are its simplicity and small cost of plant, and that no skilled labor is required to handle it. It can be worked by an ordinary blowing engine which will give a maximum pillar of 5 lb. per square inch of blast. A 2 ton converter working ten hours per day ought to make 120 tons of soft steel per week, thus placing a steel-making plant in the hands of small manufacturers. These converters can, it is stated, be increased in capacity up to any size, and worked in duplicate to any extent. An important point in this converter is that it can be worked with four or six tuyeres fixed horizontally. By a simple mechanical arrangement, which we shall illustrate in an early impression, a stopper or plug in each tuyere is actuated by steam or air and shuts the tuyere at the proper time. We may mention that the converter has been constructed by Mr. White, of Pontymister Steel Works, and the trials were carried out under his supervision and that of Mr. George Geen, of Newport, Mon.—*Engineer.*

Solubility of Glass.

We have frequently pointed out how far from correct it is to consider glass an insoluble body; and though, as regards the contamination of solutions by the material dissolved, photography is, fortunately, apparently little troubled, the slightly soluble character of glass concerns photographers in other respects very deeply. Not to speak of the action of moisture in destroying the surfaces of lenses, the manner in which the surface of the glass plates is acted upon is a matter of great importance, so many are the cases where stains in negatives are due to what might be termed "corroded" glass. Before the Chemical Society a paper has recently been read giving an account of the behavior of glass to certain reagents. The hardest Bohemian glass tubes were selected, and the substances were sealed up and then exposed to heat for some days. The contents were now taken out and analyzed. Passing over the accounts of sulphide of ammonium—which is not likely to be employed to any great extent in the photographer's dark room—we find that one hundred grammes of simple water dissolved ten milligrammes of the glass, the same amount of strong ammonia from seven to eight milligrammes, and *weak* ammonia forty-two milligrammes. These are most remarkable results, and by many would be considered as unexpected as remarkable.—*Brit. Jour. of Phot.*

NEW INVENTIONS.

Mr. Joseph W. Blaisdell, of Brooklyn, N. Y., has patented an improved fire kindler, which consists in a paper bag containing charcoal, shavings, or other suitable combustible material, the open end of the bag being twisted and then dipped into molten resin, paraffine, or other combustible material, which when hardened holds the twisted parts of the bag together and forms a very combustible wick for igniting the bag.

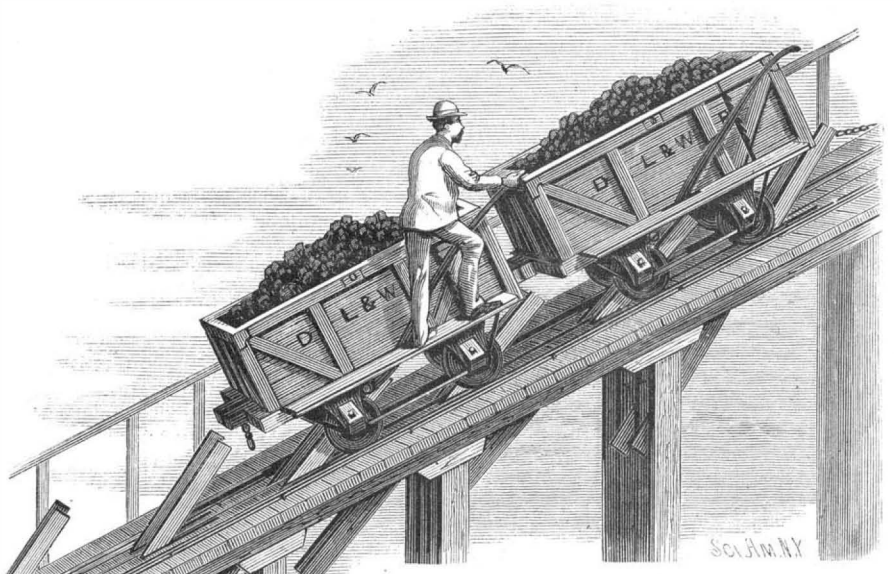
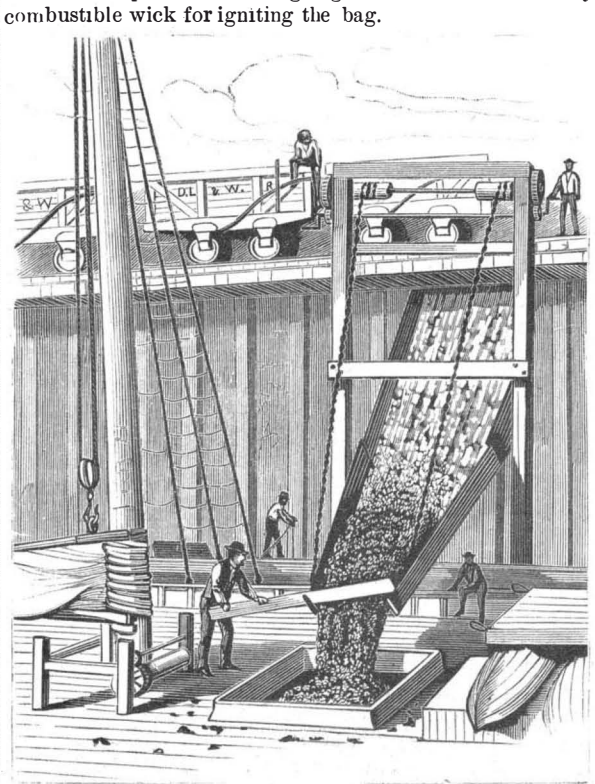


Fig. 5.—ASCENDING THE SLOPE.—SAFETY CHECKS.



THE CHUTE.

A novel blotter has been patented by Mr. Thomas C. Townsend, of New York city. The invention consists in a blotting roller provided with a balanced handle, and formed with a hinged segment that retains the blotting paper in place.

Pipes from water boilers are usually coupled to screw rings or sputs which are attached to the boiler head. Such sputs have been attached by riveting them to the boiler, but they are apt to get loose and leak at the joint. Mr. John Trageser, of New York city, has patented an improved method of connecting sputs to boilers, so that the joint will be perfectly water-tight.

In the class of electric lamps employing the electric arc as a source of light, a common cause of flickering or unsteadiness in the light is the fluctuation of the electric arc by draughts of air. Mr. Henry B. Sheridan, of Cleveland, Ohio, has patented an improvement in electric lamps designed to prevent the flickering due to this cause, and thereby avoid the principal objection to the arc lamp. In carrying out the invention the inventor surrounds the arc and adjacent points of the carbon rods with a small transparent globe provided with a movable support and capable of being closed at the bottom sufficiently to prevent a circulation of air in the region of the electric arc.

Mr. Charles B. Wilson, of Orange, Texas, has patented an improved oil can, which is so constructed that the flow of oil can be regulated conveniently. It is provided with a hollow or tubular handle, having an air vent closed by a removable cap. If the cap is removed from the end of the tube, the air can enter into this tube and the oil can flow from the nozzle. If the flow of oil is to be interrupted the thumb can be placed over or on the end of the tube.

Mr. George H. Richards, of Philadelphia, Pa., has patented an improved back-ground frame for photographers. The object of this invention is to provide folding or closing scenery or back-ground frames united in such manner that several frames are joined and compactly held, and so that any one or more of them may be drawn out and set at the proper angle for use. The invention consists principally of a main frame, in combination with sliding or moving scenery frames. The scenery frames are made reversible, and the main frame is adjustable to different heights.

Mr. George Vollkommer, of Brooklyn, N. Y., has patented a cigar mould press, which is adapted for rapid and easy operation, and it can be extended to suit moulds of different lengths.

Mr. Henry Scholfield, of New York city, has patented an improved apparatus for drying coffee, grain, or evaporating the moisture from various materials, such as green coffee, grain, etc., by heated air. The object of the improvements is to obtain rapidity of action and efficiency of operation, so that the material will be properly dried at small expense and without risk of damage by excessive heat.

Mr. Alonzo H. Savage, of Ashtabula, O., has patented a new and improved box for blacking, etc., which is so constructed that the contents will be prevented from spreading over the rim of the box, and is retained in the middle of the box. This is a screw threaded box for containing the blacking, and is provided with a lid having a large central aperture and an upwardly projecting threaded flange, the threads of which engage with those of the box. The lid is provided with a handle for turning it into the box, and has a scraper on its lower surface.

Mr. Robert W. Teese, of Parker's Landing, Pa., has patented an improved safe having an open bottom compartment at its key-hole end adapted to cover the key-hole The lock cannot be picked, as the compartment is too small to admit tools, and a person cannot see the lock from the compartment even if it would be possible to pass the tools into it. The lock cannot be blown open, as no explosives can be introduced unless a hole is drilled through the cover or door.

An improved cake pan frame has been patented by Mr. W. J. Cashen, of Portland, Conn. The frame is formed and the whole number of completed pans secured in the frame by two simple operations. After the pans and frame (now a single utensil) have been taken from the uniting press or die the whole may be retinned to make a better finish at the joints of the pans and frame.

An improvement in adjustable buggies has been patented by Mr. William T. Angus, of Sydney, New South Wales, Australia. The object of this invention is to construct buggies in such a manner that they can be readily adjusted as a single-seated vehicle or a two-seated vehicle.

Mr. William H. McKenzie, of Waverly, O., has patented a folding clothes rack which occupies but very little space and from which a large quantity of clothes can be suspended. The rack has three or more vertical rows of longitudinal rods or bars when lowered, and a large quantity of articles can be hung on the rack, and when not in use the rack can be folded compactly.

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RECENT INVENTIONS.

An improved heater and feeder for steam boilers has been patented by Mr. Frederick A. Meyer, of New York city. The object of this invention is to provide a steam boiler especially designed for the quick generation of steam and to be set in and used in combination with heating and melting furnaces, more especially those furnaces that are operated with liquid fuel. With a boiler and its immediate connections, constructed and arranged according to this invention, a high pressure of steam can be quickly produced and easily maintained.

Mr. Paul Bitterlin, Jr., of Paris, France, has patented a compound for etching vitreous surfaces. This invention consists in mixing with hydrofluoric acid a portion of any finely-divided material—such as the natural silicates, emery, etc.—which will be attacked by it. This decreases the energy of its action, and causes it to act with more uniformity and regularity upon the vitreous surface; or, if it is desired to vary the etched surface and obtain engravings of the most varying character, the inventor mixes therewith some finely-divided material, such as fluoride of calcium, oxide of zinc, etc., which the acid will not attack.

A novel can opener has been patented by Mr. Frank Sharp, of Socorro, Territory of New Mexico. This invention consists of a bar having a curved point at one end and a handle at the other. Upon the bar there is a sliding knife adjusted by a screw arranged above and parallel with the bar and journaled at the ends in the handle and in the end of the bar which is turned up for this purpose. The screw is provided with a milled thumb wheel near the handle for convenience in turning The movable knife is adjusted to suit cans of different sizes by turning the screw.

Mr. Elmer H. Slagle, of Algona, Iowa, has patented a device for supporting boots in boot boxes by means of which the annoyance experienced by retail boot dealers by the falling over and mixing up of the boots in the boxes after one or more pairs have been sold may be overcome.

An improvement in apparatus for the manufacture of starch has been patented by Mr. Anthony Atkinson, of New York city. In the manufacture of starch the final settling operation is accomplished in long troughs or tanks, through which the starch water is run, so that the starch may settle while the water escapes at the discharge end of the trough. This invention relates to these troughs, the object being to obviate the difficulty experienced from the uneven accumulation of starch, prevent waste of starch, and to insure a uniform current.

An improvement in farm gates has been patented by Mr. Daniel Spencer, of Albion, Mich. This invention relates to that class of gates which are pivoted and adapted to be swung to a horizontal position, enabling the gate to be opened when there is snow upon the ground.

Messrs. Ernest B. Walter and John P. Voelker, of New York city, have patented an improved window screen in which a screen is attached at one end to the sash and at the other to a hollow roll having a spring on the inside, so that as the sash rises it will unroll the screen to cover the opening made, and as it comes down the spring will wind up the screen on the roll.

An improved illuminated mirror which reflects light-rays upon the face of the person looking into the mirror, whereby the image of the face will be reflected very clearly and distinctly in a dark or darkened room, has been patented by Messrs. Peter Loth and Jules Sindic, of New York city. The invention consists in a mirror surrounded by a beveled frame of ground glass fitting in the front of a box lined with reflector mirrors and containing a lamp or gas light, the rays of which are reflected by a small reflector on the inner surface of the mirror, upon a larger reflector in the rear part of the box, from which larger reflector they are reflected through the beveled glass upon the face of the person looking into the mirror.

A novel water closet disinfecting device has been patented by Mr. Dwight Warren, of Winsted, Conn. The invention consists in a tube suspended on the side of the water closet or urinal bowl, and containing a disinfecting compound, a part of which is dissolved by water entering into the tube through a very small aperture near the lower end every time the bowl is flushed with water. Both the lower and upper ends of the tube are closed, the upper end being preferably closed by a cup containing vaporizable disinfectants or perfumes, and is covered by a perforated cap.

Mr. Frederick A. Meyer, of New York city, has patented an improved liquid-fuel injector, which consists of a double hemispherical covered vessel, having a steam space between its outer and inner shell, provided with an internal diaphragm to effect the better mingling of the steam and liquid fuel, with a receptacle for receiving the excess of oil or liquid fuel that may at any time enter the injector, and provided with a relief pipe for the escape of such of the oil that is there vaporized, and provided with suitable discharge nozzle, with valved oil and steam supply pipes, and with an adjustable steam pipe that controls by valvular action the admission of the liquid fuel or oil into said injector.

An improved refrigerating bedstead has been patented by Mr. Charles P. Jackson, of Chicago, Ill. This refrigerating bedstead is for cooling, refreshing, and purifying the air in a sick chamber. It consists in a bedstead having an ice box held a suitable distance above it, directly below which ice box a drip pan is suspended, provided with inwardly inclined flanges to prevent the water from splashing or flowing over the sides of the pan when the bedstead is moved suddenly, and with tubes for carrying off the drip water.

Mr. Dwight Warren, of Winsted, Conn., has patented a disinfecting compound consisting of sulphate of alumina, permanganate of potash, and bichromate of potash, combined in certain definite proportions.

An Ambidexterous Surgeon.

In an interesting obituary notice of Dr. Pancoast, the celebrated surgeon of Philadelphia, the *Times* of that city says:

The great point in his career was his skill as an operator. He was ambidexter, and could perform operations of the most delicate intricacy with his left hand which were beyond the skill of others using the right hand only. It was, in part, the extraordinary facility with which he could employ both hands at one time which made him so successful in the department of plastic surgery. By the removal of strips of flesh from the forehead and elsewhere, he has formed no less than a dozen noses for persons who, either through accident or disease, were without them. There is a woman standing in the Callowhill Street Market for whom he made a nose twenty-two years ago, and no one can detect it now from nature's own best handiwork. He was the first to show that after the eyebrow has been destroyed a good looking substitute can be made by raising a flap of the scalp with the soft, drooping hairs of the temple, and giving it what is termed a "long pedicle" to run into a bed cut for it in the brow. He also furnished maimed humanity with eyelids and ears. So far did his fame as an operator extend that one of the things which visiting foreigners marked down as of the greatest interest in Philadelphia was "to see Dr. Pancoast operate." His hands looked clumsy, but he could take up a large knife, as on the occasion of the visit of the Japanese party some years ago to see him perform amputation at the hip-joint, and the next moment he could take the finest needle and operate upon an eye. He was among the first to resort to the section of the facial nerve for the relief of neuralgia. He was remarkably successful in operations for cataract, and early improved upon the operation of "couching" by complete extraction. In the treatment of strabismus, or squint, he was in his day unrivaled. At the same time, the record of his larger operations, from lithotomy to amputation at the hip-joint, is one of extraordinary brilliancy. He was never systematic, and was not at all particular about his selection of instruments. On several occasions he performed delicate operations with an ordinary penknife, beause other instruments were not at hand.

Town-building Industries.

One of the noteworthy and encouraging features of American industrial life is the very common development in out-of-the-way places of thriving manufacturing towns, based for the most part on new inventions. It often happens that a wide-awake mechanic, young business man, or farmer, utilizes some local advantage for the manufacture of a simple article which he has invented and patented, starting a small shop where a man of large capital would never think of locating. One successful invention almost invariably paves the way for more of the same sort; while the creation of a new center of productive industry, however humble, attracts thither, of necessity, the more active minded, both of those who want to work and those who want to have work done, in the region round about.

In this way there grow up in the most unexpected places manufacturing towns which attain not unfrequently a world-wide reputation through or by means of their peculiar products.

The busy little town of Waynesborough, Pennsylvania, is in many respects an illustration of this feature of American life. The names of fully one-fourth of its entire population are on the pay-rolls of one firm, Messrs. Frick & Company, whose growing establishment for the manufacture of agricultural engines and railroad machinery is the industrial mainspring and support of the place.

The farm engines, traction engines, grain separators, and sawmill machinery are making a wide demand. Recently fourteen separators were dispatched at one time, and a day or two later thirteen engines and several sawmills were shipped by one train.

The Elephant in the Middle Ages.

Matthew Paris mentions that the Soldan of Babylon, Malek el Kamel, sent an elephant as a rare present to the Emperor Frederic II., in the year A.D. 1229 (Sir Frederick Madden's edition of the "Historia Minor," vol. ii., p. 314). But it was not until the year 1255 that the first elephant was seen in England. This was presented by the King of France to King Henry III. The chronicler, John of Oxenedes, chronicles the arrival of this animal at London, and declares that it was believed that none had ever been brought to England before. Of the elephant, Matthew Paris made a very good drawing, the original of which is still extant among the Cottonian manuscripts in the British Museum (Nero, D. I.); and an equally good, but smaller, drawing is given by John de Walingeford, in another Cottonian manuscript (Julius, D. VII.). The beast arrived at Sandwich, and was conveyed to the Tower of London, where the sheriffs had been directed by royal precept to build a house for it, 40 feet in length and 20 feet in breadth, taking care to let the building have sufficient strength to be fit for any other purpose. The animal itself was ten feet in height from the top of the back to the ground, and was ten years old. It lived on to the 41st year of Henry III., A.D. 1257, in which year it appears from the "Chancellor's Roll" that for the maintenance of the elephant and its keeper, from Michaelmas to St. Valentine's day, immediately before the animal died, at the age of twelve years only, the charge amounted to £16 13s. 1d. The name of the keeper is recorded to have been John Gooch. Many chroniclers mention this elephant—(*e. g.*, Matthew Paris, iii., 334; Annals of Burton, i., 329). The "Majora" of Matthew Paris states (vol. v., p. 489) that no elephant had ever before been seen on this side of the Alps, but that statement will hardly agree with the record of the elephant presented to the German Emperor in A.D. 1229, as already mentioned. Crowds of people went to see the king's elephant, according to this author, and we may well believe it. The drawings seem to indicate an Indian rather than an African elephant, but it is difficult to determine the question.

Correspondence.

Self-acting Car Couplers.

To the Editor of the Scientific American:

In an article entitled "Railroad Inventions Wanted," by W. S. Huntington, published November 19, 1881, an automatic coupler for freight cars was mentioned. Soon after seeing the article I designed an automatic coupler that I claim fills the requirements set out in that article to the letter, and so say scores of competent judges. Yet when I show it to railroad officials, those in authority who might adopt it, they condemn it at once and that without hardly looking at it, and without showing one single fault in it—just condemn it on general principles. And when I ask them why it won't work, their reply invariably is (in sum and substance) that "You can't make an automatic coupler that will work on freight cars. They have been trying that for the last twenty-five years, and they never could make it work. Self-couplers will do for passenger cars, but not on freight cars." That is about the way they all condemn it. The fact of the matter is there is no invention in existence that meets with as much opposition as an automatic car coupler, and no inventor will ever make a fortune out of an automatic car coupler until the law compels the railroads to use them. It will be a heavy expense to the railroads to adopt them, and that is the reason "you can't couple freight cars automatically."

Terre Haute, Ind. R. K. WOOD.

Resistance of Dynamo Machines.

To the Editor of the Scientific American:

Some time ago Mr. Weston and I had a discussion in your columns regarding the proper resistance of dynamo machines. Mr. Weston then claimed that low resistance machines were wrong in principle and impractical. Mr. Edison then claimed by his practice that a low resistance machine was the best form. His experiments have now resulted in a practical machine, which is running in London, having a resistance of one two-thousandth of an ohm. On this resistance he is able to convert 125 horse power of energy into electricity with a minimum loss, and to avail himself of 97 per cent of the electricity outside of the machine.

FRANCIS R. UPTON.

Menlo Park, N. J., March 28, 1882.

[The results here given are certainly very remarkable.—ED. S. A.]

Iron Ore in North Carolina.

Chattanooga, Tenn., is rejoicing in the discovery, in Mitchell County, N. C., of two veins of magnetite of superior quality, one eighteen feet, the other thirty-four feet wide. The veins were cut while tunneling for a railway on the property of the Cranberry Iron Company. This discovery insures, it is thought, an abundant supply of steel-making ore for the Chattanooga district.

Earthquake in Central New York.

Two distinct earthquake shocks were felt at Amsterdam, N. Y., and throughout the adjacent towns, April 2. Houses were considerably shaken. The first shock was felt between six and seven o'clock in the morning; the second and severer shock at 8:10.

CEMENT FOR GLASS AND METAL.—Every one who uses brass letters on glass windows, and knows how often they tumble off from unequal expansion, or from the too energetic efforts of window-cleaners, will be glad to have the following recipe: Litharge, 2 parts; white lead, 1 part; boiled linseed oil, 3 parts; gum copal, 1 part. Mixed just before using, this is said to form a quick-drying and secure cement.

WALNUT TREES SHOULD NOT BE TRANSPLANTED.—A correspondent of the Detroit *Free Press*, anent the undertaking of a man in Michigan to reset 1,000 black walnut trees for commercial purposes, says that they cannot be transplanted and retain their vigor. They should be grown from the nuts. He has made experiments by both transplanting and raising from the seed, which has convinced him that the latter is much the preferable way.

A ZOOLOGICAL NECROPOLIS.—A company, styled the Zoological Necropolis Company, has been formed in London. Its business is to provide "a burial place for pet animals, dogs, cats, and little birds."

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STEAM BOILER NOTES.

REMARKABLE EXPLOSION.

The boiler of the tugboat Henry C. Pratt, lying at pier No. 8, foot of Walnut street, Philadelphia, Pa., exploded at 4:30 A.M., March 23, killing four men, and causing the burning and sinking of the tugboat Ella, lying at the wharf below, and the burning of the passenger and freight station-house of the Philadelphia and Atlantic City Railway. It is believed that the furnace doors were left closed until the steam pressure rose so high as to explode the boiler. The latter was but four years old, and said to be a good one.

The verdict of the coroner's jury stated that there was too much steam pressure on the boiler, and that the boiler was handled in a reckless manner. The jury recommended that the United States law compel two safety valves to be attached to each boiler.

SAFETY VALVES.

The terrible results of the tugboat boiler explosion given above, and the sensible verdict of the coroner's jury, draw attention in a special manner to the subject of safety valves, since the jury very properly recommend "that the United States law compel two safety valves to be attached to each boiler." There is in Philadelphia a municipal regulation of this kind relating to stationary boilers, and, although it would seem to be almost a sure precaution against disasters from overpressure, yet the din of the Wilt & Son's and the Gaffney explosion, both of which boilers were in Philadelphia, and fitted with two safety valves each, according to law, has scarcely died away. The clamor that followed the former disaster was prolonged by a memorable and still (said to be) unsettled law suit, brought by the widow of the dead engineer against the Hartford Steam Boiler Inspection and Insurance Company, she claiming the extravagant damage of $50,000 for the loss of her husband; while the Gaffney explosion of last summer brought out the subject of cast iron flat boiler heads, and a severe censure of the same insurance company by a jury of experts.

The former was a case of weakness of the boiler, and the latter had every appearance of having been a case of inoperative safety valves, two precisely alike, both on the same steam nozzle, and both sworn to as having been stuck in their seats on former occasions. The history of this case may be found in the SCIENTIFIC AMERICAN, dates of July 2, 9, and 30, and SUPPLEMENT No. 308.

We have constantly admonished steam boiler owners to see to it that their safety valves were well kept, and that their boilers were not getting weaker from unusual wear and bad usage. The other very necessary precaution is a working supply of water; a preventive of excessive deterioration rather than of immediate disaster well understood and generally well attended to by the most stupid boiler attendant, since he believes that his life depends upon observing it.

Low water is, however, sometimes the cause of frightful disasters, equivalent many times to an explosion of a boiler shell, from the overheating and softening of large flues and furnace crowns. The application of two safety valves to each boiler is, however, strongly recommended both for land and marine use; and such valves as are in reality safety valves, first, last, and all the time.

The great importance of this subject is well understood by government inspectors and by insurance inspectors, although neither are in condition to enforce their opinions and insist on expensive changes in existing conditions. Personal interests and business consideration can hardly be eliminated from the minds of both the officials and the owners of the boilers.

Many of the rules adopted by the United States Board of Supervising Inspectors relate to steam boilers to be built after the approval of the rule. The one relating to safety valves, Rule 36, begins thus: "Safety valves to be attached to steam boilers, intended for steam vessels built six months after the approval of this rule, shall have an area of not less than one square inch to two square feet of grate surface, when the common safety valve is employed." This rule was promulgated in 1877, and it appears that all the thousands of boilers in steam vessels then navigating the waters of the United States will be exempt from the operation of this rule so long as the old boilers can be made to hang together and bear the official test.

"But when safety valves are to be used, the lift of which will give an effective area of one half of that due to the diameter of the valve, the area required shall not be less than one half of one square inch to two square feet of grate surface." This is the second section of Rule 56, and relates to reactionary valves, some of them known as "pop" safety valves.

The construction of this class of valves is such that when the steam pressure is sufficient to raise the valve slightly from its seat, it passes the seat proper and impinges on a larger disk area, or issues downward, guided by an annular lip of the valve, against the area surrounding the seat, which causes the valve to rise more quickly and higher than the common lever valve does at an equal pressure of steam.

It will be seen that the government rule quoted above allows the use of this class of safety valves having a disk area of one half that required in the common disk valve, provided the issuing steam at working pressure will lift the valve so high that the annular opening between the valve and its seat shall equal one half the area of the free opening through the seat. For example, a valve 2½ inches diameter will have approximately an area of 5 square inches. Its circumference is 7·854; the lift must, therefore, be about 0·32 inch to give the required half of 5 square inches area. This appears to be about one-eighth the diameter of the valve, so that a one inch valve must rise one-eighth inch, and a two inch valve one-quarter inch. It will be entirely safe to recommend one valve of each class for each steam boiler, and that they be both kept in perfect order at all times.

ENGINEERING INVENTIONS.

An improvement in car trucks has been patented by Mr. Gustavus B. Simonds, of Albuquerque, Territory of New Mexico. This invention relates to that class of railroad trucks known as the "diamond truck;" and it consists in improvements in the construction of the bolster by which the truck is made firm and rigid, and may be run with safety should a spring lose out or get broken, the spring hanger and sand boards being entirely dispensed with.

An improved coal excavator has been patented by Mr. Henry Wilverth, of St. Charles, Ky. This invention relates to that class of excavators in which a rod of iron with a pick projecting in line from its end is used, and its object is to enable the operator to make a long and deep trench. The improvement consists of a grooved wheel journaled in a swiveled trunnion bed or pillow block and supporting in its groove the excavating rod and pick. An adjustable weight is secured on one end of the rod to counterbalance the weight of the pick on the opposite end.

Mr. Albert Berryhill, of Pittsburg, Pa., has patented an improved nut lock which consists of two grooved blocks held in a longitudinal slot of a plate placed on the bolts and over a recessed plate, which in turn is placed against the fish plate or against a plate resting against the fish plate, which blocks are held against the nuts to prevent them from turning by a locking wedge placed between them and into the recess of the recessed plate, parts of the slotted plate being bent outward to form an aperture to admit the locking wedge.

An improvement in valve operating mechanism has been patented by Mr. Louis C. Lugmayr, of Water Valley, Miss. The object of this invention is to work the valves of steam engines for cutting off with one eccentric, and also allow reversal of the engine with the same mechanism. The invention consists in a slide block connected with the eccentric and valve rod and carried by a guide pivoted to swing for shifting the valve.

A novel spring has been patented by Mr. Roger A. McLean, of West Bay City, Mich. This invention consists of a box or well cast with vertical channels in which are loosely placed spring metal strips arranged in pairs upon and across or at right angles to each other in such manner that the strips are free to move downward either at their ends or in the center in answer to the load, the whole being surmounted with a suitable follower attached to or separate from the load.

Mr. John F. Taylor, of Sharon Springs, N. Y., has patented a simple and convenient device for unloading, transporting, and dumping cargoes of guano, sand, and other bulk cargoes from vessels. The invention consists of a bucket provided with trunnions, by which it is supported on a car frame, so that it can be hoisted therefrom and lowered into a vessel to be filled, and then be replaced in position and transported on the car to a place for unloading, when it can be turned upside down on its trunnions and be emptied.

An improved car roof has been patented by Mr. Gustavus B. Simonds, of Albuquerque, Territory of New Mexico. This invention consists in a corrugated sheet metal covering for the roofs of railroad cars, attached so that the contraction and expansion of the metal will not exert injurious strain upon any part of the roof.

Mr. John M. Sailer, of Ionia, Mich., has patented an improved valve reversing gear, which will easily and readily regulate the lead of the valve during the stroke of the engine, and may be used to reverse the motion of the engine when desired. The invention consists of a novel eccentric adjusting cam in combination with the valve rod eccentric, the latter being loosely fitted on the engine crank. The adjustment is secured by sliding the cam in one direction or the other by means of a clutch lever.

Mr. Austin Leyden, of Atlanta, Ga., has patented an improved car coupling. This invention consists in providing mechanism whereby the bolt may be operated from the sides, top, or platform of the car without the necessity of going between the cars to connect and disconnect them, as is now the practice, and of an automatic stop adapted to hold the bolt elevated until the link enters the bumper.

Mr. James L. Griffin, of Cusseta, Texas, has patented an improved device for coupling cars automatically. The invention consists in a lever pivoted in the front of the top of the draw head and provided at its outer end with an aperture, through which the coupling pin is passed into the aperture in the draw head, below which lever another lever is pivoted, hanging vertically across the front opening of the draw head, and provided at the upper part of its inner edge with a projection, so that when the coupling link pushes the lower lever inward the upper lever and the pin are raised, and drop as soon as the link has passed into the draw head. The draw head is provided with two apertures at the sides for the coupling pin when it is not in use. The coupling pin has an annular recess directly below the flattened head, for retaining this coupling pin in the aperture of the pivoted lever.

An improved crank paddle has been patented by Mr. Julius I. Lengsfield, of Greenville, Miss. The object of this invention is to construct a propeller in which the paddles enter and leave the water in or near a perpendicular line, and thus avoid the striking and lifting of the water. The paddles are so arranged as to propel the vessel continuously. The depth of the stroke is adjustable.

Preserving Fence Posts.

A correspondent of the *Country Gentleman* says: I have tried a number of methods of preserving posts, and none have been satisfactory except perhaps one to be mentioned presently. Heart oak, if seasoned, will last a great many years without any application whatever—how many I am not old enough to say. Sap wood will not last. Coal tar has some preservative effect, but after having used it on thousands of fence posts I am almost convinced that its application does not pay. In fact I am so nearly without faith in its efficacy that I have not used it at all on fence posts recently set, although I have a barrel on hand purchased chiefly for that purpose About my yard and premises I have set, since the war, a good many posts of pine, that being the only sawed timber I could get. These have had to be replaced in four or five years after setting; some have completely rotted off in three years, though heavily dosed with hot coal tar.

Now for the exception referred to above. Ten years ago I built a grapery at the end of the house, as a screen against the western sun, using sawed pine posts Anticipating the difficulty of ever replacing these posts after they became covered with vines, I took the extra precaution of completely saturating the lower ends with kerosene—common coal oil—before applying the tar These posts are now perfectly firm, and almost as sound as they were when put in. All other pine posts set at that date have entirely rotted and perished. The result of this experiment so thoroughly impressed me with the value of coal oil as a preservative of timber under ground, that I now use it on all posts in building, afterwards covering with hot coal tar. This is essentially the plan proposed by Mr. Parker Earle.

I add this, however, which I think will doubtless prove of great value: I bore a half-inch or three-quarter inch hole in the post near the ground, slanting downward and reaching beyond the center, this is to be filled with kerosene from time to time—perhaps once in three or four years will answer. I feel sure that insects very greatly hasten the decay of timber, to say the least; and kerosene being repellent to them, makes it a valuable application at any point where they are likely to do mischief.

Electrical Capacities of Heated Bodies.

It is well known that a burning match or a gas flame acts as a discharger of electricity, and the fact has been applied by Sir William Thomson to his portable electrometer in observing the potential of the atmosphere at any point Recent experiments of Professor Guthrie, F.R.S., have shown that an incandescent platinum wire also acts as a discharger of electricity, and displays a preference for discharging a negative rather than positive charge. If a platinum wire, made incandescent by an electric current, is placed between two gold leaf electroscopes, one charged with positive and the other with negative electricity, it will be found that the negative charge is rapidly drawn off, while the positive charge remains almost unaffected. The wire in this experiment was at a dull red heat; and it is probable that a higher temperature would also have affected the discharge of the positive electricity. Professor Guthrie likewise shows that a red-hot metal ball at certain high temperatures will not accept a charge of positive or negative electricity from the conductors of a glass electrical machine; while at certain lower temperatures it will accept a negative charge, but not a positive one, and at still lower temperatures it will take both a positive and negative charge.

Glacier Scratches in the Catskills.

Dr. Julien, in the Transactions of the New York Academy of Sciences, vol. i., No. 2, states that he has found no *glacial scratches* near the Clove above 2,900 feet, the highest observed occurring on the "High Ledge," Parker Mountain, at 2,871 feet, and on the southeast slope of Round Top at 2,871 feet; the direction of the former S. 18° W., magnetic; of the latter S. 35° E. He remarks that the highest scratches observed in the Catskills occur on Overlook Mountain, at an elevation of about 3,100 feet, showing that the ice surface was at least 3,200 over this part of the Catskill region, He concludes that there were two movements over the region—the movement of the Continental glacier southeastward, and that of the Hudson River valley, southward.

THE important event for Newfoundland, the first railway trip, took place on March 12. The train ran in on the road as far as it is ballasted, a distance of about ten miles, and then returned to town, the party expressing themselves highly pleased with the success of the trip. It is a strange coincidence, says *India and the Colonies*, that the steamer that landed the first locomotive ever seen in Newfoundland was the one that thirty-two years ago first connected Newfoundland with the United States and British North America by carrying the mails. But the steamship Merlin has degenerated since those days. She was then a steamer of the Cunard line; she is now a seal hunter, the property of Mr. A. M. McKay, superintendent of the Anglo-American Telegraph Company.

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INTERESTING EXPERIMENTAL BOILER EXPLOSION.

The first experiment by Mr. D. T. Lawson, of Wellsville, Ohio, was exploding a steam boiler of practical size, which contained the usual working quantity of water. It took place on June 16, 1881, and was illustrated and described in the SCIENTIFIC AMERICAN and SUPPLEMENT of December 24 and 31. As then stated, the object is to define the nature of the causes of boiler explosions, and to show the efficiency of the experimenter's patent device in the prevention of that class of explosions that occur upon opening the engine throttle valve or other principal steam outlet of the boiler after an interval of rest. Mr. Lawson's device consists of an arched perforated diaphragm fixed horizontally near the water line inside the boiler.

An illustration of it, as applied to a horizontal two-flue boiler, was given in the SCIENTIFIC AMERICAN of July 4, 1880.

In accordance with a determination formed after his first experimental explosion, Mr. Lawson had two boilers made of the best iron, duplicates in form, size, and materials of his first one. One of these contained the diaphragm and the other did not. They were horizontal cylinder boilers, thirty inches diameter by six feet long, the shell of two plates of three sixteenths inch and the heads of three-eighths inch iron. The heads were stayed by a one-inch iron bolt which passed from end to end through the center of both heads. The diaphragm in one of these boilers was of three-sixteenths boiler iron, flanged and riveted to each boiler head and along each side of the shell, as indicated by the rivet heads and dotted lines, Fig. 2. The top

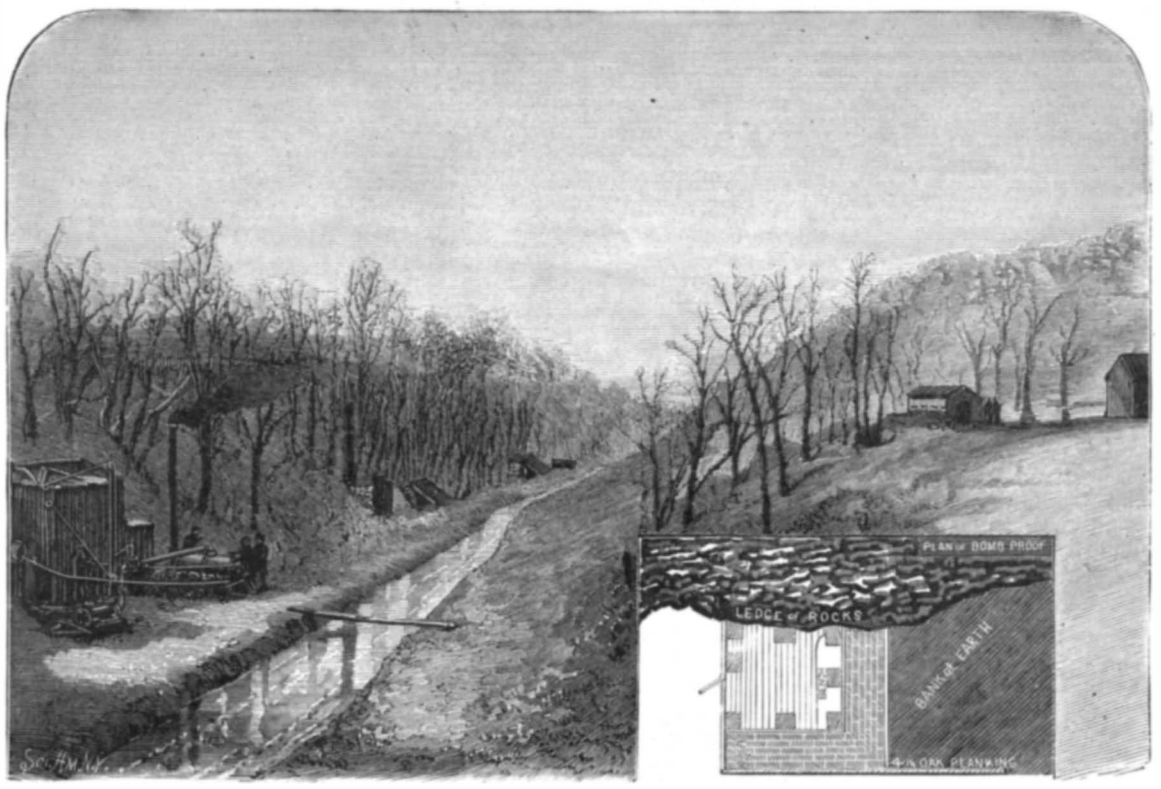

Fig. 1.—VIEW OF THE MUNHALL VALLEY, SHOWING THE ARRANGEMENT OF LAWSON'S EXPERIMENTAL BOILER.

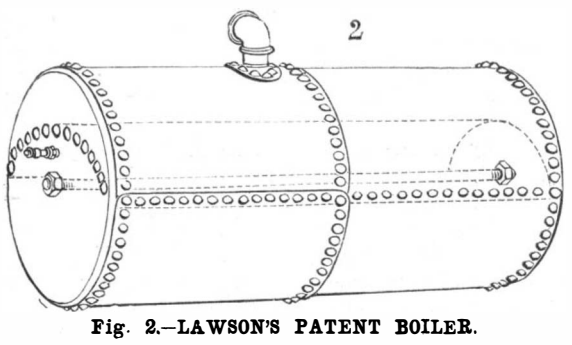

Fig. 2.—LAWSON'S PATENT BOILER.

of the arch of the diaphragm was about seven inches below the summit of the cylinder. There was also in the patent boiler a man-hole of the usual size in the rear head. The opening was re-enforced by a strong wrought iron rim riveted to the boiler head. There was no man-hole in the other boiler.

The second series began on February 17, and after an interruption of some time, occupied in perfecting arrangements and procuring standard pressure gauges, they were continued on and after March 7, and ended with the explosion, herewith illustrated, on March 22.

Fig. 1 shows the scene of the explosion, Munhall Valley, on the west bank of the Monongahela, about eight miles from Pittsburg, Pa. It was here the government explosion experiments were conducted in 1873, the buildings shown being the bomb-proof structures erected by the commission. The sectional plan on the right of Fig. 1 is that of the bomb-proof used by Mr. Lawson. A large upright boiler and a high pressure steam pump remain in the pump house, and an unused steam boiler lies near the upper bomb-proof, relics of the work of the commission. One of the buildings on the right (Fig. 1), also bomb-proof, was for the accommodation of visitors, who could there get a view of the whole line of operations through horizontal crevices cut in the joints of the heavy timbers.

On February 17, Mr. Lawson's patent boiler having been set up, as shown in Figs. 1 and 3, the second series of experiments began. The boiler was set in masonry, and connected with it were fifteen feet horizontal and about three feet vertical lengths of three and a half inch wrought iron steam pipe, leaving the top of the boiler at the middle of its length and entering the stuffing box of an old empty steam engine cylinder eight inches diameter and thirty-six inches long. Near the elbow of the pipe which turned downward toward the old cylinder was a three and a half inch quick-opening gate valve, seen in Fig. 3, and enlarged in Fig. 4, of the Eddy pattern. In the head of the old cylinder was a Mississippi gauge cock, which could be operated from the interior of the bomb-proof. The boiler furnace was fitted with a half-inch iron pipe, which entered through the side wall just below the bottom of the boiler and extended in a perforated section across the furnace for the distribution, upon the incandescent coals, of liquid fuel supplied from a barrel placed at a safe distance in a cavity of the bluff (seen at the left of Fig. 1). The flow of oil from the barrel could be regulated by a valve at the door of the bomb proof, as shown.

Inside the bomb-proof were two pressure gauges (only one at first experiment, February 17), both connected to the front head of the boiler, one above and the other below the diaphragm, to indicate the pressure and the disturbance in the steam and in the water pressure when the three and a half inch gate valve was suddenly opened.

At the first experiment of this series it was found that the apparatus was not complete, and especially that the pressure gauge was 50 to 100 pounds "too fast" when compared with the United States standard gauge used by the local inspectors of steam vessels, as far up as that standard reached. The pressure was, however, run up on this first occasion to 275 pounds by the imperfect gauge, which was estimated to be equal to 225 by the standard, and a number of shocks were made by pulling open the steam gate at various pressures below, and at the maximum pressure then obtained.

On the 7th of March, the plain boiler having been set up a little further from the bomb-proof, the adjourned experiments commenced; but after several attempts to get a high pressure in this boiler (having no diaphragm or man-hole, but in all other respects like the patent one), it had to be abandoned, one of the heads having cracked on three short radial lines around the center bolt, so as to cause a leak, which prevented the increase of pressure beyond about 220 pounds. These cracks were apparently started by the violent use of a large drift pin, to enlarge the bolt hole, unmistakable marks of which appeared on cutting out the center portion of the head for repairs. A prominent lip was turned all around the inner edge of the hole. The patent boiler was reset substantially as before, with more perfect appliances for handling the gate valve, the lever of which had proved insufficient, and on the 20th of March steam was again raised, and shocks were made at every 25 pounds rise till 300 pounds pressure by the standard gauge was indicated, when a last shock was given without producing an explosion. The diaphragm was then cut out except a margin all round, through which the rivets passed, about three inches wide (see Fig. 5). The main portion, which was too wide to pass through the man-hole, was left loose in the boiler.

On the 22d of March the operations of the 20th were repeated, with twenty inches depth of water in the boiler.

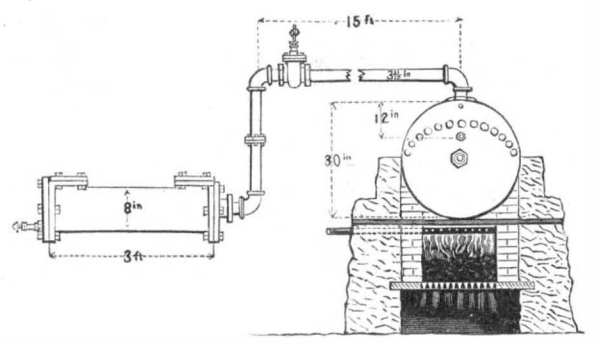

Fig. 3.—ENLARGED ELEVATION OF LAWSON'S APPARATUS.

The pressure rose in six minutes from 175 pounds to 235, the valve having been opened every 25 pounds as before, and the last time after a rise of 10 pounds. When the gate was opened at 235 pounds pressure the boiler exploded with terrific force, all the water disappearing in an atomized form; each elementary globule of one thousand pounds of water, at 400° Fah., simultaneously (not progressively as powder burns) exploded and was diffused in practically ultimate atoms, like a cloud of steam in the air, Fig. 6.

The boiler was literally torn into shreds, beginning probably with the breaking of the one-inch stay bolt, which was the most heavily loaded section of the parts of the boiler. Thus, if the bolt sustained one-quarter of the load on the thirty-inch boiler head when the pressure reached 235 pounds, it would be subjected to a strain of 66,000 pounds to the sectional square inch, or 40,000 pounds upon the six-tenths of a square inch, which it had at the threaded ends—quite enough to break a threaded bolt. The sudden pulling of the nut through the boiler head would have been followed by similar phenomena, namely, an apparently simultaneous destruction of all the stronger parts of the boiler, which are then acted on by a moving and not a statical force, as when the boiler was whole; moreover, the force acts on

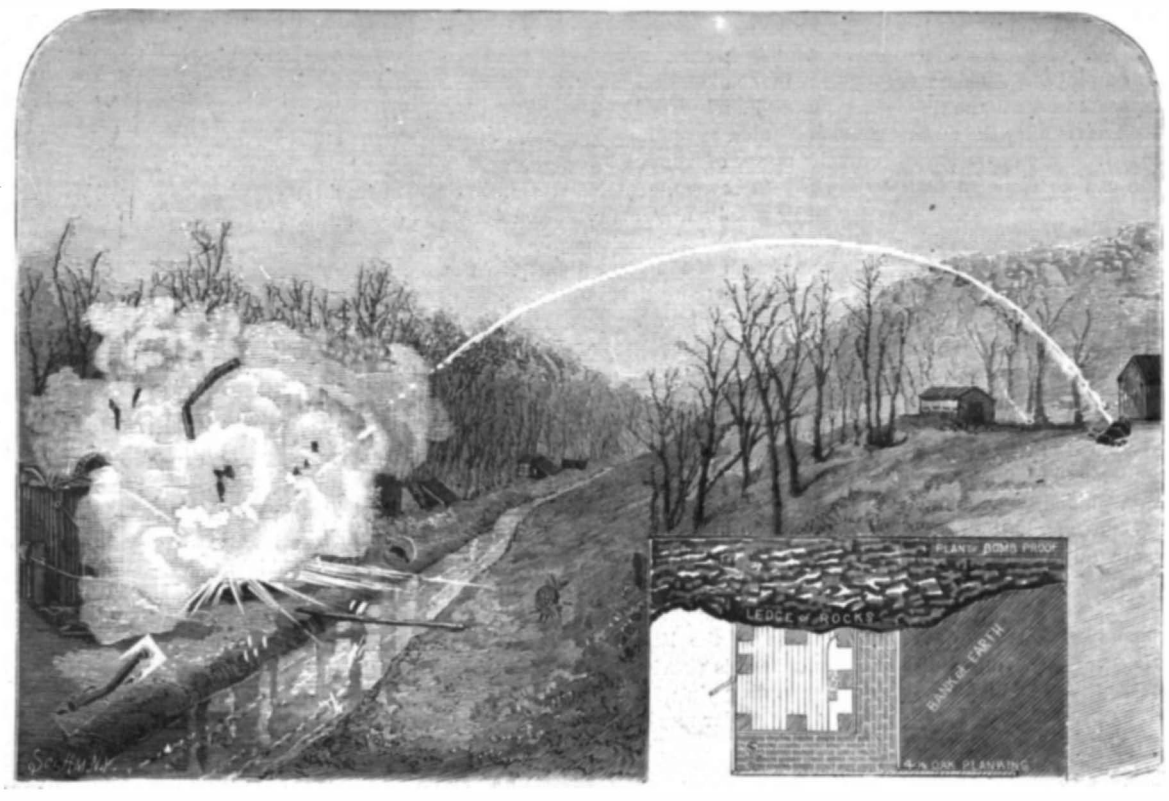

Fig. 6.—LAWSON'S EXPERIMENTAL BOILER EXPLOSION.

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the plates of the shell once broken open in a cross-tearing direction, as one tears a sheet of paper, instead of as one would break a string, or as the test samples of iron are broken in a machine. It will occur to the reader that this construction of these experimental boilers was admirably adapted to the end Mr. Lawson had in view.

The cracking of the head around the bolt of the plain boiler, at the experiments of March 7 and 8, probably rendered it impossible to get a breaking strain on the bolt, and the rupture of the iron was slow enough to prevent the pulling through of the nut in a sudden manner before the pressure fell and equilibrium of force and resistance was established.

The record of the commission appointed by the Secretary of the United States Treasury—Supervising Inspector of Steam Vessels, John Fehrenbatch, of Cincinnati, O., and Deputy Inspectors Atkinson and Batchelor, of Pittsburg, Pa.—show that which was also observed by a representative of the SCIENTIFIC AMERICAN, namely, that the pressure always fell on opening the gate valve, and then the gauge fluctuated to a point above, settling at last sometimes at apparently the same, and sometimes at a lower point than that from which it started downward—a perfectly natural and often observed result of suddenly withdrawing one-tenth of the volume of the steam from a boiler to which a sensitive spring gauge is attached.

When the gate valve was opened it was equivalent to suddenly enlarging the steam chamber of the boiler about one-tenth of its capacity; but, inasmuch as the sudden lowering of the pressure was followed by an evolution of steam from the water, which had a normal temperature of 400° Fahr. when under a pressure of 235 pounds above the atmosphere, the theoretical effect of withdrawing one cubic foot of steam would, under these conditions, be a lowering of the pressure something less than one pound, provided no heat is entering the boiler at the instant or during the oscillations of the gauge pointer.

But the gauges used upon these occasions were graduated to five pounds, having no pound or half pound marks, and they were not reliable as indicators of actual variations. It appears, first, that the pressure at which these tests were made left but little margin of strength in the boiler; and, second, that the area of the opening from which the steam was suddenly withdrawn was about one two-hundredths of the surface area of the water, and these conditions, compared with the usual manner of opening the valves, will be recognized as immense exaggerations of the most vicious practices in the use of steam boilers.

While Mr. Lawson's experiments show that a boiler may explode while it contains a full supply of water, they do not, on the other hand, show that boilers do not sometimes explode from lack of water. While they also show that a big throttle valve may be suddenly opened with impunity while a proper margin of strength remains, they do not prove that a weak boiler will or will not break at the instant the engine throttle is opened, producing a very mild shock.

On the whole these experiments, so far as they have gone, are simply confirmatory, almost a demonstration, of the opinions held and taught by the SCIENTIFIC AMERICAN for many years, as well as by many well informed writers and thinkers on the subject of boiler explosions.

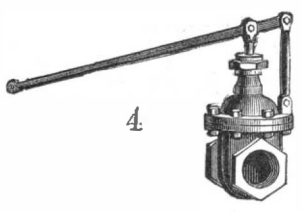


Fig. 4.—3½-INCH GATE VALVE.

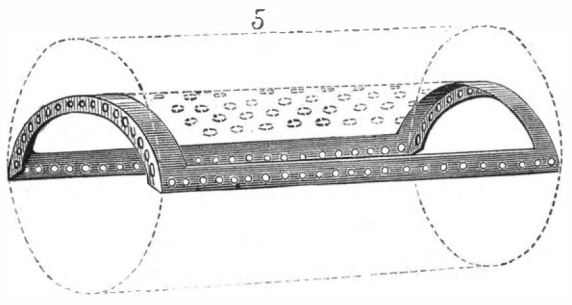


Fig. 5.—BOILER WITH DIAPHRAGM CUT OUT.

New Electrical Regulator.

M. Salignac, one of the most active electricians of Paris, has discovered a new regulator which will be one of the curiosities of the next *grande soirée* given at the Observatoire on March 13th. Each of the two carbons is supplied with a parallel rod of glass, to which it is attached in a solid manner. These two rods being placed horizontally, are pushed by a spring, and the spark is lighted between them. But between the two glass rods there is a glass stopper which is warmed by the light in such proportion that the rods yield gradually to the pressure of the springs, and the carbons can approach each other, as is required for the constancy of illumination. A correspondent of *Nature* witnessed preliminary experiments which he states have been a wonderful success.

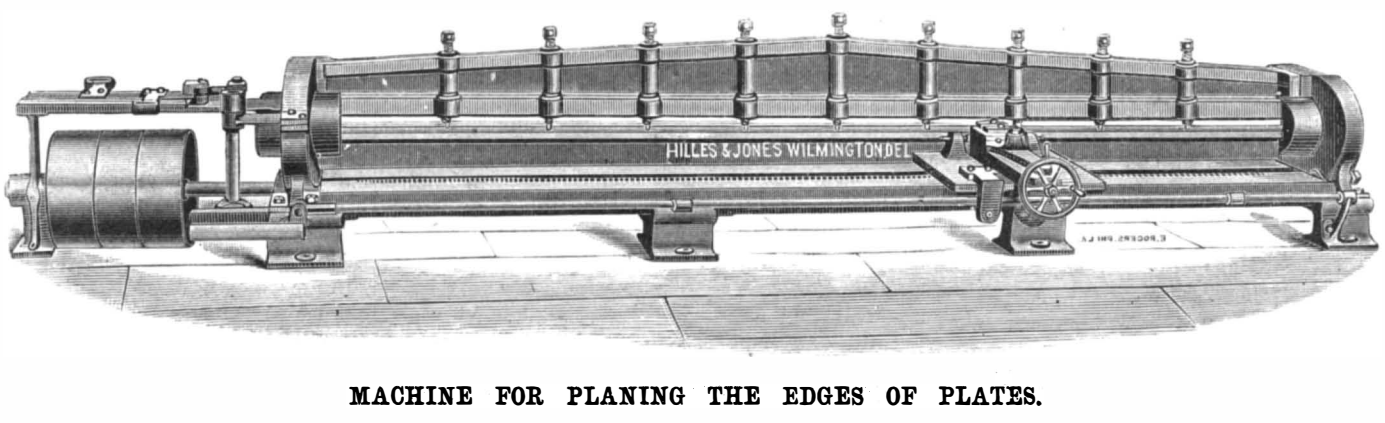
IMPROVED PLATE PLANER.

We give an engraving of an improved machine, made by Messrs. Hilles & Jones, of Wilmington, Del., for planing the edges of plates. This machine will plane 13 feet 10 inches long at one setting, and by resetting or moving the plate endwise will plane any length of plate. There are two separate tools on the tool post, and they are arranged on the saddle for easy and independent adjustment, and the cut is taken both ways on the plate; the hand wheel shown feeds both tools at the same time.

The machine is so designed that the large table holds the plate and at the same time answers for a gauge for quickly setting the edge of the plate, so that no time is lost in measuring with a rule. The nine screws in the cross bridge are for straightening and taking the buckles out of the edge of the plate, and at the same time they assist in holding it securely while being planed.

The large steel screw that moves the saddle is supported its entire length, lying in a groove that keeps it always well oiled and prevents it from being sprung or bent. The belt shifting arrangement is such that a very short movement of the saddle is obtained when desired.

The manufacturers state that this machine will do as much work in one hour as the best boiler maker will chip in twelve hours. The machine will do it correctly, while the boiler maker will do it irregularly and in a great measure cut or score the adjoining sheet, thus weakening it.



MACHINE FOR PLANING THE EDGES OF PLATES.

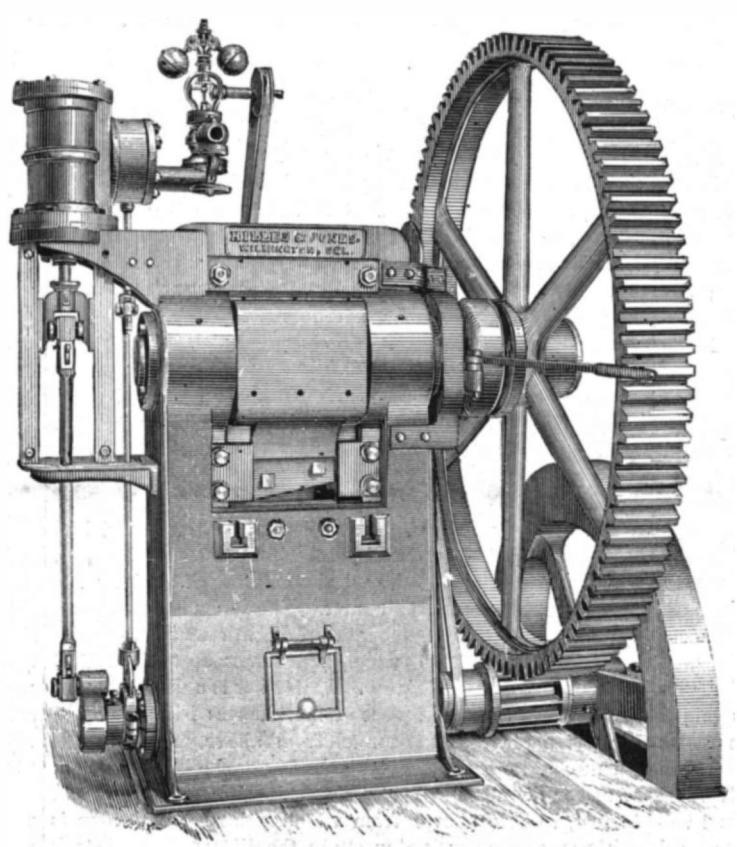
POWERFUL BAR IRON SHEAR.

The annexed engraving shows a powerful steam driven shear built by Messrs. Hilles & Jones, of Wilmington, Del. There are four sizes of this machine, the one shown in the engraving being the largest. It is capable of cutting flat iron six inches wide by two inches thick.

These machines will cut flat, round, or angle iron, and are made with a clutch for stopping and starting the cutter while the fly wheel and gearing are in motion. A bar of iron can be cut accurately to the mark, and a gauge is provided, set on the back of the machine, for cutting a number of pieces of uniform length.

This is is a most serviceable tool for locomotive builders, bolt makers, bridge builders, bar iron rolling mills, or for cutting puddle bars in sheet mills.

The machines are furnished with tight and loose pulleys for driving with a belt, or provided with a pony engine, as shown in the engraving.



HILLES & JONES' BAR IRON SHEAR.

MECHANICAL INVENTIONS.

A novel wire stretcher has been patented by Mr. Henry H. Hutchins, of Fennville, Mich. The invention consists of a hooked bar or plate carrying pivoted jaws at its hooked end, and provided near its center with a hooked lever having a pawl for securing the device to the fence post, and carrying at its straight end a clamping device for retaining the wire while a hold is being taken with the jaws, a suitable guide being provided for guiding the wire to and through the clamping device.

An improved system for transmitting motion has been patented by Mr. Antonio Samper, of Paris, France. This patent relates to improvements in a system of transmission of movement patented by the same inventor June 21, 1881, No. 243,226.

An improvement in paper pulp engines, patented by Mr. William E. Taylor, of Fulton, N. Y., consists in setting the blades of the cylinder at an angle or diagonally across the surface of the cylinder, so that they will have a shaving action or cut with the fixed blades in the bottom of the engine box.

An improved self-closing elevator door has been patented by Mr. Theodore M. Clark, of Boston, Mass. The invention consists in combining a pivoted latch bar and a bow spring on the door frame with a door having a stud and an elevator platform having a lug for engaging the spring. This device is simple and efficient. It allows the use of self-closing doors without its being necessary for the elevator attendant to hold them open.

Ordinarily in stereotyping the mould or impression is taken and dried on a steam table or heater specially constructed and used for that purpose alone. It is then placed in a casting box specially constructed for that work. These appliances are costly and occupy no little space. Mr. Marshall J. Hughes, of Jersey City, N. J., has patented a combined printing press and stereotype casting box which dispenses with these separate appliances by utilizing printing presses in the work of stereotyping and production of plates and type-high casts.

Mr. Frank A. Carnes, of Brookline, Mass., has patented an improved carriage axle box. By means of the collars or rings and the hollowing out of the nut or sleeve, the bearing surface of the sleeve upon the axle is greatly reduced, thus reducing the friction to the minimum. A hub of this construction can be made small and compact, and it is simple and cheap in construction.

Mr. Edgar H. Drake, of Newfield, N. Y., has patented a novel combination of simple and well known mechanism for applying power for domestic and other purposes. The invention consists of a combination of shafts, cranks, pinions, cog wheels, eccentrics, pitmen, walking beams, connecting rods, treadle, etc., supported in a suitable frame. The arrangement is such that the power may be applied by hand, foot, or by weights to operate a saw, churn, or washing machine.

Mr. George P. Clark, of Windsor Locks, Conn., has patented a cheap, efficient, and easily operated means for preventing backward movement of hand trucks while the load is being placed upon them. The invention consists of a spring-actuated holder or clamp placed upon the shaft or axle of the truck, the holder or clamp being adapted to be pressed down by the foot of the user to engage with the floor while the box, barrel, or other load is being tipped or pulled back or otherwise placed upon the truck.

An improved self-lubricating bearing for axles has been patented by Mr. Paul Decauville, of Paris, France. This invention provides small pieces of cane or reed, which dip continually into a reservoir of oil. The great porousness of the cane is specially advantageous in two respects for the purposes of this invention—that is to say, the oil is caused to rise by capillary attraction and by the suction caused by a vacuum. In the case of shafts revolving at a very low speed the lubrication is effected by capillary at-

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traction; but in the case of shafts which revolve at a great speed—such, for example, as those used for ventilators—the lubrication is effected by a rush of oil resulting from the vacuum caused by the great speed of rotation.

Fishing reels become quickly worn at the bearings of the spool and gearing, and as usually constructed are expensive to repair when so worm. Mr. Julius Vom Hofe, of Brooklyn, E. D., N. Y, has patented an improvement in fishing reels which provides for adjustment of the bearings, so that wear can be readily compensated and the reels kept in good condition without expense.

An improved mechanism for converting rotary into oscillating motion has been patented by Mr. Julius Hornig, of Jersey City, N. J. The object of this invention is to improve the construction of the mechanism for converting rotary into oscillating motion, for which letters patent, No. 46,237, were granted to the same inventor, February 7, 1865, and reissued letters patent, No. 3,717, were granted to the same inventor, November 9, 1869, the design being to facilitate and cheapen the repairing of the mechanism should it be broken by being overtaxed.

An improvement in breech-loading firearms has been patented by Mr. Henry Scott, of Birmingham, England. This invention has reference to breech-loading small arms of the kind commonly called "drop-down guns;" and it consists in the arrangements or combinations of parts for cocking the concealed or internal hammers of the guns, and also the arrangement of safety apparatus for preventing the accidental discharge of the guns.

An improved shedding mechanism for looms has been patented by Mr. Joseph Denton, of Paterson, N. J. The invention consists in the combination with the heddle slides, crank wheel, connecting rod, rock shaft, and the rigid arms of a series of connecting rods, levers, and stop-board, by which the inward movement of the heddle slides is controlled.

Mr. Sigmund Ullman, of New York city, has patented a new machine for perforating checks and drafts. The invention consists of a plate containing a series of loose punch pins arranged in longitudinal rows marked "units," "tens," "hundreds," etc., and in transverse rows marked "0," "1," "2," "3," etc., which punch pins fit into perforations in a die plate below the punch plate, and provided with a guide or gauge for the end of the check or draft. Above each longitudinal row there is a sliding bar with a beveled notch in its under surface, and with the numerals from 0 to 9 on its upper surface, one of which numerals is visible through an aperture in the top plate, this notch being so located that it will be above the punch pin corresponding to the number showing through the aperture, and when the punch plate is depressed the punch pins under the notches will not be depressed, and consequently the corresponding numbers on a prepared check will not be punched, and will show the value of the check, whereas all the other numerals will be punched.

The Presence of Glycerine in Beer.

It has been shown by Pasteur and others that glycerine is a normal product of alcoholic fermentation; that investigator proved that out of 100 parts of sugar submitted to complete fermentation, 95 parts are converted into alcohol and carbonic acid, 1 part is added to the newly formed ferment, and 4 parts are converted into succinic acid and glycerine, and the results of his quantitative researches proved that 3·16 parts of glycerine are produced from every 100 parts of sugar fermented.

These were the results obtained by normal alcoholic fermentations, but Pasteur also found that when the fermentation is slow or is produced by exhausted and impure yeast, the amount of glycerine may be appreciably increased, and, on the other hand, when there is an excess of albuminous and mineral matters in the fermenting fluid, the production of glycerine is considerably diminished; the presence of any excess of acidity in a fermenting fluid also tends to prevent the formation of glycerine.

It may be safely said that glycerine is never absent from a fermented liquid, but the quantity varies according to the nature of the liquid submitted to fermentation. A non-nitrogenous beer wort, such as is produced when sugar or saccharines have largely replaced malt, will, during fermentation, yield a very considerable quantity of glycerine; but with a very nitrogenous and slightly acid wort, such as is yielded by malt alone, very little glycerine is produced during fermentation.

It seems, therefore, possible that if some exact method of determining the quantity of glycerin in fermented liquids were known, we should, by ascertaining the percentage of this constituent in a beer, be able to decide with some degree of certainty whether such beer has been produced from malt alone, or from a mixture of malt and sugar. Unfortunately, chemists are not at present acquainted with any exact and ready method of estimating glycerine, the one devised by Pasteur being too complicated for any but the most experienced, and even then we doubt whether extreme accuracy can be insured by it.

The following method of quantitatively testing for glycerine in beer may be found useful: The beer is mixed with powdered slaked lime and an equal bulk of fine quartz sand, and evaporated to a paste on the water bath. When cold, the residue forms a hard mass, which is pulverized and extracted with 80 to 100 c. c. of a mixture of equal volumes of absolute alcohol and ether in a small stoppered flask. On allowing the extract to evaporate, the glycerine is obtained free from sugar. If two drops of it are put in a dry test tube with two drops of phenol (previously liquefied), and the same quantity of sulphuric acid, and heated very cautiously over the flame, but so as to reach 120°, the formation of a solid brownish-yellow mass is perceived. When cold a little water is added and a few drops of ammonia, when the brownish-yellow solid dissolves with a splendid carmine red color.

The detection and estimation of glycerine and the other bye products of fermentation in beer, etc., would tend to throw further light on what is at present very obscure.—*Brewers' Guardian.*

Worm-eaten Wood.

A number of worn and worm-eaten pieces of wood were lately shown at the Public Works Department. They were specimens of wood which had been in use as piles and fenders on government wharves and breakwaters on the Atlantic and Gulf coasts, and had been sent to the department as illustrative of the necessity of the frequent renewal of timbers in these constructions.

One was a piece of hemlock timber from the railway wharf at Point Duchene, N. B. This piece, which had been in use as a fender, put on in 1873 and removed last year, was, by the ravages of worms and the incessant action of the sea, reduced to about one-half its former circumference, excepting the knots, the hardness of which had preserved them intact, giving the timber the appearance of a decayed tree, having the limbs lopped off about six inches from the stem. Another, a part of a pile taken from Digby, N. S., had in fourteen years' exposure to the worms become completely useless for strengthening purposes, while a section of a pile driven at Shediac, N. B., in 1878, had in only three years been so perfectly honeycombed as to be seemingly unable to withstand its own weight. Other pieces of spruce hemlock were also seen in various stages of destruction and decay, showing the incapability of these descriptions of wood to resist the ravages of the destructive little creatures. It is not only the weakening of the timber by the perforations of worms that renders it useless in a short time, but the wood having once become porous thereby, it is rendered susceptible to the continuous action of the water, and is thus worn down with wonderful rapidity. These worms vary in size in different waters, and the appearances of a similar wood exposed for any length of time in the waters of the Gulf and those of the Atlantic Ocean, might be compared to that between the finer and coarser varieties of sponge. Some kinds of wood are more impervious to worms than others; thus in localities where spruce and hemlock timber would, in a short time, become thoroughly worm-eaten, birch and elm would remain intact for years, yet in all cases it is but a matter of time, and only solid stone is of sufficient durability and strength to withstand effectually the ravages of these worms and the constant wearing of the waters.

Effects of Compression.

The experiments of M. Walthère Spring, a Belgian physicist of much originality of mind, upon the influence of pressure upon solid bodies, have attracted some attention. He continues to publish the results of his experiments as they are extended in new directions. The method of procedure is to subject solid or pulverulent matter to pressures reaching a maximum of 10,000 atmospheres in an apparatus constructed of steel. In this way some highly interesting results have already been attained. Coal dust, for example, was changed by simple pressure into a solid block, presenting all the characteristics of the original mineral. Peat was changed at once, by the same means, into a black block of mineral, of brilliant fracture, which did not show any sign of organic texture. At a pressure of 6,000 atmospheres this solidified peat became plastic. Several observers are said to have pronounced the solid material thus obtained to be precisely like ordinary coal; and on carbonizing it a solid block of coke was produced. It is stated that further experiments in the same direction have convinced M. Spring that heat, accompanied with a pressure of only 200 or 300 atmospheres, would have sufficed for the production of coal measures in their present condition. Soft metals in the form of fine powder, and nearly all crystalline substances in a similar condition, have been transformed by M. Spring into more or less solid blocks, occasionally of higher specific gravity than the original form of the matters so treated.

A Fan Ventilator.

The engineers of the St. Louis Bridge and Tunnel Company have, for several months, contemplated the placing of an air suction pump or pneumatic screw in the St. Louis railway tunnel, and have experimented with the old-established institutions in this line, but without satisfactory result. Finally Mr. C. Shaler Smith, of St. Louis, laid before the company the designs of an invention of his own, which met with approval, and the building of the new fan or screw was begun last summer. The screw is now in successful operation at the corner of Eighth and St. Charles streets, midway of the tunnel, and comes up to the fullest expectations of the designer. Following is a description of this new and improved piece of mechanism: First, an opening was made into the tunnel from above, and over this opening an immense circular chimney or stack was erected, 37 feet in diameter at the base and tapering to a diameter of 15 feet, 76 feet above, from which point upward there is neither increase nor diminution in the diameter. The stack is made of five-eighths-inch boiler plate, is double riveted and strengthened every 10 feet by four-inch angle bars. Its weight alone is over 92 tons and its entire length 126 feet.

At a distance of some ten feet from the base of the stack a shaft connected with a 192 horse power compound engine enters the stack at right angles and passes through the center. To this shaft is attached the fan, which is coniform, with lateral wings at the ends of the cone. These wings are eight in number, four of which are large and of equal size, and four small. The larger wings are attached to the sides of the cone, and to each of these a small wing is attached at the outer edge of the larger by means of a flange. The longitudinal diameter of the fan is 15 feet, its breadth of rim 8 feet 10 inches, and its weight 8 tons.

The whole fan is cased or boxed up, and the air cannot possibly enter the fan box, except through an opening at either side of the fan. At the top of the fan box there is another opening, through which the air is blown by the fan into the stack and up into the blue sky.

The fan, when running at a high rate of speed, exhausts the air at the rate of 500,000 cubic feet per minute, and can exhaust the amount of air in the tunnel in four minutes. It is, in fact, a wonderful piece of mechanism, and will be appreciated by all railroad men and especially by firemen and engineers.—*Age of Steel.*

Power Required for Wagons and Carriages.

At a recent meeting of the Engineers' Club of Philadelphia, President Rudolph Hering presented notes on the resistance to traction on streets giving results compiled from various authors who had experimented on the subject. Resistance varies nearly as the weight, being great for heavy loads and almost nothing for light pleasure carriages. It increases on paved streets with the velocity and as the diameter of the wheels becomes less. The width of tire has little influence on hard and smooth roads, especially for light loads, while it has considerable influence on soft and rough roads, particularly when the load is heavy. The most economical conditions for traction, therefore, are a hard and smooth surface, large wheels, and broad tires; the latter for heavy loads drawn on rough roads. To draw a load on sand requires a power equal to one-fifth its weight, on ordinary earth one-tenth, on hard clay one-twentieth, on ordinary cobble stones one-sixteenth, on good cobble pavements one-thirtieth, on ordinary Belgian blocks one-fortieth, on London blocks one sixty-second, on asphalt one one-hundred-and-thirty-third, and on iron rails one two-hundredth of the load.

The economy in horse power obtained by using the hardest and smoothest roads is clearly shown. If one horse can just draw a load, on a level, over iron rails, it will take one and two-thirds horses to draw it over asphalt, three and one-third over the best Belgian, five over ordinary Belgian, seven over a good cobble stone, thirteen over a bad cobble stone, twenty over an ordinary earth road, and forty over a sandy road.

The Daily Swelling of Plants.

With delicate means of measurement Herr Kraus has recently proved the existence of a phenomenon in all plant organs, which is connected with their variable water-content, and consists in a periodical swelling and contraction in the twenty-four hours. Leaves, etc., decrease in thickness from the early morning till the afternoon, when they begin to swell again, attaining a greater size by night than by day (this is well seen in agave, aloe, and the like). Similarly with buds, flowers, green cones, fruits, etc., and with stems and branches. Herr Kaiser had before proved such a period in trunks of trees, and Herr Kraus shows that both wood and bark share in it, independently or unitedly. The various experiments of Herr Kraus—removal of foliage, watering, shutting out light, etc.—lead to explanation of the phenomena by the varying reciprocal action of those factors which bring water into the plant and those which carry it away. By night only the water-absorbing activity of the parts below ground operates, by day the water-consuming activity of the parts above ground besides. The water-consuming activity depends mainly on the foliage and on light (removal of leaves or of light stops the contraction) and consists essentially in transpiration. Herr Kraus states that when a plant is watered these things occur: In a short time, less than an hour, the stem begins to swell; both wood and bark take part in this, the wood always first. The swelling progresses at a pretty quick rate, upward of several meters per second. After some time, perhaps an hour, contraction gradually recurs. The contraction began at the upper part of an acacia after 10 minutes, whereas the swelling at the lower part continued 50 minutes. This shows that the contraction is due to the activity of the foliage, and is gradually extended downward.

Narrow Escape of a Steamship.

A desperate and exciting race for life was made across a part of San Francisco Bay, on March 23, by the ocean steamship Columbia. In approaching the city in a dense fog the ship grounded in the straits, but in a few moments glided off into deep water. Suddenly it was discovered that the vessel was leaking badly, and the captain determined to steer for a safe beaching ground. Under a full head of steam, and followed by a fleet of tugs, which endeavored to keep near her, to render help if it were needed, the ship rushed toward the mud flats. Her firemen stood waist-deep in water, and she was slowly sinking, but there was just time to save her, and, amid a chorus of shrieks from a hundred steam whistles, she ran high up on the soft shore near her wharf.

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AGRICULTURAL INVENTIONS.

Mr. Charles H. Roberts, of Poughkeepsie, N. Y., has patented some new and useful improvements in preserving forage, such as dry cornstalks, by storage in silos. The invention consists in moistening, wetting, or saturating the dry or partly dried stalks and plants—such as cornstalks—before or after they are placed in the silo, and they are then packed and compressed in the silo in this moistened state. In carrying out this invention, the dry or partially dried cornstalks from which the corn has been husked are cut into pieces of about three-eighths of an inch in length, or longer or shorter as may be desired; but the stalks should always be cut as finely as possible. In place of cutting the stalks, they may be mashed or broken by rollers or other suitable devices, or may be reduced to small pieces in any other suitable manner. These finely cut or reduced cornstalks are to be packed in a silo. Before or after cutting the stalks, or before or after being packed in the silo, these finely reduced cornstalks are sprinkled, moistened, wetted, or saturated with water or steam, or each layer is wetted or moistened in the silo. The cornstalks are packed and compressed in the silo in this wet or moistened state. It is desirable to get all the water into the stalks that they will absorb and retain after compression by the usual methods of compression of ensilage in silos. The object to be obtained by moistening or saturating the cornstalks with water is to restore to them about the amount of water the stalk, leaves, and husks have lost in maturing or by drying before or after being cut. The water absorbed by the cornstalks renders them soft and succulent, and adapted to be used as forage and packed in a silo. The results obtained with this forage have been highly satisfactory in every respect. This dry cornstalk forage can be stored in the same silo with the green ensilage, for the green corn (ensilage) is packed into the silo early in the season, and settles one-fourth to one-third of the entire depth. The dry cornstalks are taken from the fields after husking—that is, later in the season, and the silo is refilled with the forage prepared from the cornstalks after husking the corn.

An improvement in cotton planters has been patented by Messrs. Anthony W. Byers and James C. Dorser, of Sherman, Tex. The invention consists in the combination with the slotted hopper bottom of the hinged and curved cut-offs, whereby the escape of seed will be prevented, except as forced out by the prongs of the feed wheel.

An improved harrow evener has been patented by Mr. Hermann H. Fischer, of Osage, Neb. The invention consists in a harrow evener constructed of two triangular frames hinged to each other by a rod; and in the combination, with the harrow frame and the doubletree, of two triangular frames and their hinging rod, whereby either part of the harrow frame can be raised from its rear end or outer side to discharge collected rubbish without affecting the other part.

Messrs. John W. Jory and Arthur B. Jory, of Salem, Ore., have patented an improved grain header which will remove the heads of the grain and leave the whole of the stalks standing, however much the stalks may vary in length.

A novel milk cooler has been patented by Mr. Ellis F. Smith, of Polo, Ill. The invention consists in providing the side of the can with a chamber or tube, closed at the top, but open at the bottom, which tube or chamber is provided with an opening a little below the water line, the can being provided with an opening within the tube or chamber above the water line.

Mr. Abraham C Scarr, of Maryborough Township, Ontario, Canada, has patented an improved sulky harrow and seed sower combined, having such action that its teeth will not have a tendency to follow the edges of the furrows nor leave narrow unbroken ridges in the soil, but will cut the soil in all directions, causing complete pulverization of the soil and perfect covering of the seed without the necessity of cross-harrowing the field, and also to provide a harrow which cannot be easily clogged with sods or similar things, and in that manner prevented from free and perfect action and rendered hard of draught, as is the case with harrows of ordinary construction.

An improvement in nut locks has been patented by Messrs. James C. Beamer and John M. Richardson, of Carthage, Mo. The invention consists of two plates of strong sheet-iron wide enough to cover the fish bar, with each edge resting on the rail. Each plate is centrally slotted, and the edges of the slot are turned outward wide enough and long enough to stand out over both nuts in the end of a rail. These plates are connected at one end with a spiral spring, and their other ends are formed into hooks that go around and under the ends of the fish bar.

An improved corn planter and fertilizer distributer has been patented by Mr. William Cassill, of Hamden Junction, O. This is a simple and ingenious machine, contrived so that it will drop seed accurately and will distribute fertilizers evenly.

Railway Grades and Distances.

In an argument lately presented to the Advisory Commission of the trunk line railroads, touching the question of rates for freight traffic, Mr. E. H. Walker, statistician of the Produce Exchange, submitted some interesting and valuable figures relative to the grades upon our principal East and West railways. He finds that the distance from Chicago to New York by the Michigan Central, Canada Southern, and New York Central is 979 miles; by the Lake Shore and Michigan Southern and the Canada Southern 980 miles; by the Erie 974 miles, and by the Pennsylvania 912 miles. The distance from Chicago to Philadelphia by the Pennsylvania is 822 miles, and from Chicago to Baltimore by the Baltimore and Ohio is 840 miles, and by the Pennsylvania is 807 miles. The ascending grades on the Baltimore and Ohio going west from Baltimore are 231 miles, with an average ascent of 24 feet per mile, and the ascending grades going east from Wheeling, for 148 miles, average 30 feet to the mile. On account of a lack of data the gradients of the 461 miles between Wheeling and Chicago cannot be given, but Mr. Walker says it is not probable that they are less in crossing the States of Ohio, Indiana, and Illinois, about midway between the lakes and the Ohio River, than the roads passing near the level of the lakes—they are probably much more. Wheeling is 379 miles distant from Baltimore by the Baltimore and Ohio, and is 645 4-10 feet above the sea level. Wilson's Summit, 221 miles west of Baltimore, and 158 miles east of Wheeling, is 2,620 feet above the sea level.

By the Pennsylvania Railroad, Pittsburg is 354 miles from Philadelphia, and is 736 feet above tide-water. The summit of the Alleghanies, 2,154 feet above the sea level, is at Gallatzin, 250 miles west of Philadelphia, and 104 miles east of Pittsburg. Harrisburg, 105 miles west of Philadelphia, is 313 feet above the sea level. From Harrisburg to Philadelphia, for the distance of 105 miles, the gradients are irregular, and range from 5 feet to 43 feet to the mile. The gradients from Philadelphia to New York, 90 miles, are light nearly the entire distance, with none exceeding 26 feet to the mile. The grades from Spruce Creek, 215 miles west of Philadelphia, and 770 feet above the sea level, to Gallatzin, 250 miles west of Philadelphia and 40 miles from Spruce Creek, show a rise from 770 to 2,154 feet, being for 10 miles from 59 feet minimum to 95 feet maximum per mile. The gradients from Pittsburg to Chicago, 468 miles, probably considerably exceed those of the lines of road nearer Lake Erie.

By the Erie Railroad, the distance from Jersey City to Salamanca, 1,390 feet above the sea level, is 413 miles, and to Dunkirk, 582 feet above the sea level, is 456½ miles. The summit between Jersey City and Dunkirk is at Tip Top, 1,783 feet above sea level, and 345 miles west of Jersey City and 111½ miles east of Dunkirk. The gradients of this railway from Salamanca to Chicago will probably compare very favorably with either the Pennsylvania or the Baltimore and Ohio Railway. Port Jervis, 88 miles west of Jersey City, is 441 feet above tide level.

The gradients of the Central line are more favorable than either of the other roads. Those of the Hudson River division are very little more than those of the Hudson River itself. The greatest elevation going west on the New York Central is from 17 feet above tide level near Albany to 341 feet between Albany and Schenectady. Buffalo is 577 feet above the tide level. Batavia, 32½ miles from Buffalo, is 908 feet above tide level, which marks a rise in that distance of 331 feet, or about ten feet to the mile. From Batavia to Rochester there is a descending grade from 908 to 513 feet above tide level. From Rochester to Seneca River there are generally descending grades, from 513 above tide level at Rochester to 379 feet at Seneca River. From Seneca River to Syracuse there is a rising grade from 379 to 407 feet above tide. From Syracuse to Manlius there is a slightly rising grade from 407 to 413 feet above tide level. From Manlius to Wampsville there is a rising grade from 413 to 448 feet above tide level. From Wampsville to Green's Corners there is a rising grade from 448 to 488 feet above tide level. From Green's Corners to Rome there is a descending grade from 488 to 439 above tide level. There is a descending grade from Rome, 439 feet above tide, to 287 feet above tide at Schenectady. From Schenectady there is a rising grade in 11 miles from 287 to 315 feet above tide level, and then a descending grade for 11 miles to Albany 17 feet above tide level. The Canada Southern Railway is nearly as level as the waters of Lake Erie. There are no heavy grades on the Michigan Central or the Lake Shore and Michigan Southern roads. The level of the latter road nearly conforms to the level of the waters of Lake Erie. During the navigation season the trunk lines utilize the water transportation from Western lake ports to Buffalo, Erie, and Sandusky. Continuing, Mr. Walker says that railway engineer experts calculate that in operating a railway every foot of gradients makes an additional cost in the operating expenses, compared with the cost of operating a water level road, equal to an additional mile of level road. If this is so, the roads having the heavy grades are many miles longer than the New York Central or the Erie road. The distance from Chicago to Baltimore in lineal length is 134 to 140 miles less than to New York, and to Philadelphia is 152 to 158 miles less than to New York. The gradients of the Baltimore and Ohio and Pennsylvania roads are, however, many feet greater than the Erie or the New York Central—very much more than the difference in the length of the roads.

Fogs.

At a recent meeting of the Physical Society, London, Mr. Newth exhibited some interesting experiments illustrating the formation of fogs. In 1875, Mr. Marscart showed that mere reduction of temperature or pressure in the atmosphere might not give rise to fogs unless the air were pervaded by solid particles of smoke or certain gases, such as sulphurous acid gas, to form a nucleus for the water vapor to condense upon. This fact was ably demonstrated last year by Mr. Aitkin, of Falkirk, and Mr. Newth's experiments were designed to show it on the lecture table. For this purpose he had arranged a bulbous flask of glass connected to an air pump, and containing a little water in the bottom of the flask. The beam from an electric lamp could be thrown through the flask so as to illuminate the interior. Mr. Newth first admitted some of the mote-filled air of the room into the flask, and by partially exhausting it produced a thick fog; but on washing out the motes by agitating the water in the flask, the fog became far less appreciable. A small quantity of smoke introduced into the flask produced a thick fog; so also did the fumes from a piece of burning sulphur, and even a platinum wire rendered incandescent by an electric current gave off sufficient solid particles of dust or other matter to produce a fog. The inference is that even with gas grates and stoves we shall not get rid of fogs, though they be of a lighter color and less dense than with coal fires.

New Method of Wine-Making.

It is well known that the art of making wine according to the old method practiced over one thousand years ago, although for the most part still in vogue, is no longer adapted to the requirements of the present day. Owing to the various diseases to which the vine has of late become prey, grapes have increased considerably in value, so that it is of great importance to get the utmost out of them. By the old method, a very considerable quantity of valuable substances to which wine owes its aroma, body, and color, remains in the marc after musting.

Adolph Reihlen, of Stuttgart, has patented a simple and profitable process which opens a new era in wine industry, because it affords a means of thoroughly utilizing the grapes. An increase in the percentage absolute quantity of wine produced is attained, without, as in the case of Petiot's and Dr. Gall's method, affecting the quality of the wine.

Reihlen operates as follows: The berries are gently pressed, the must heated to boiling, and the marc mixed with the boiling must for three or four minutes, whereby the coloring matters, tartar, aroma, and other valuable substances, are extracted, and at the same time the injurious albuminous substances are rendered insoluble. The marc is, however, not quite exhausted by this process, but is capable of imparting the rest of its still valuable contents to weak wines, so-called fruit wines, and saccharine liquids generally. By Reihlen's method (which has been in operation since 1880), when purple grapes are worked up for wine, a deep bluish-red must is obtained in a few minutes without fermentation, the quantity of coloring matter extracted by the boiling must being from three to seven times as much as that extracted according to the old method after three months' fermentation. Reihlen further prepares the marc of purple grapes in such a way that even after years this will impart a color to red wines which have become bleached, or revive the taste of deteriorated wines.

What has been said about red wines applies equally to white wines, and the bouquet peculiar to the Riesling and Traminer grapes admits of being imparted to the must from other kinds of grapes. Another peculiarity of Reihlen's process consists in using the carefully edulcorated grape-skins which are taken out while hot, drying them, and using them as a ferment. Reihlen states that grapeskins prepared in this way excite in must and in sweetened old and young wines, a fermentation of the sugar without any formation of yeast. The explanation of this apparent anomaly may be, perhaps, found in the theory that the ferment adheres very closely and persistently indeed to the skins, and the molecules of sugar being only brought in contact with it by means of the circulation of the liquid caused by the formation of alcohol and heat of fermentation. It then appears that the ferment is possessed of an extraordinary power of splitting up sugar. The result of these mutual combinations is, that the fermenting wine always appears clear.

Wine authorities are of one mind as to the value of Reihlen's discovery, and it seems likely that wine making according to this method will soon become universal. The Œnological Institute in Stuttgart is now testing the matter.—*Wiener Freie Presse.—Chem. and Drugg.*

Remarkable Example of Refraction.

Herr Hakonson-Hansen draws attention to a remarkable phenomenon due to refraction, observed by him at Trondhjem, on January 17, and similar in all respects to one witnessed by him at the same place on November 15, 1881. On both occasions, at 2: 50 to 3 P.M. in the day, a rose-colored stripe was seen to stretch across the sky from about northwest to east. From the middle of this rose a vertical column of a somewhat lighter red color, and inclining on its western side to a shade of yellow, the whole being intensely luminous. After remaining visible for about ten minutes, the bright reds and yellows gradually faded away, leaving nothing but a blackish gray streak across the heavens. The sudden and striking apparition of this vertical column recalled, as Herr Hansen observes, the descriptions given in past ages of bloody crosses seen in the heavens, and regarded as prophetic of coming wars and pestilence, and he remarks that if it had been seen at a later period of the day, it might have been taken to be a specially brilliant aurora.

FLOUR PASTE.—Flour, four ounces; water, 1 pint; nitric acid, 40 minims; oil of cloves, 5 minims; carbolic acid, 5 minims. Thoroughly mix the flour and water, strain through a sieve, add the nitric acid, apply heat until thoroughly cooked, and, when nearly cold, add the oil of cloves and carbolic acid.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Samples of H. W. Johns' improved Asbestos Steam Packing will be sent free to inquirers. H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

Lehigh Valley Emery and Corundum Wheels are acknowledged to be the safest, freest cutting, and most durable wheels in use. Write for prices, stating sizes you use. L. V. E. W. Co., Lehighton, Pa,

Kochendoerfer & Urie, General Brokers, 200 Broadway, will attend to any business in New York.

For Sale—A Second-hand 6 Horse Engine and Boiler W. W. Oliver, Buffalo, N. Y.

Pure Water furnished Cities, Paper Mills, Laundries, Steam Boilers, etc., by the Multifold System of the Newark Filtering Co., 177 Commerce St., Newark, N. J.

100 New Lathes, Planers, Drills, Millers, etc. (light and heavy). Send for list. Kelly & Ludwig, 49 and 51 North Seventh St., Philadelphia, Pa.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

For Sale.—Iron Planers, 2 x 8 feet; new. N. L. Sibley, Waltham, Mass.

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Now Ready. Catalogue of Electrical Books; also general catalogue. E. & F. N. Spon, 446 Broome St., N. Y.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N.H.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 188.

Send for Pamphlet of Compilation of Tests of Turbine Water Wheels. Barber, Keiser & Co., Allentown, Pa.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N.J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works. Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N.H., and N.Y. city.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Improved Skinner Portable Engines. Erie, Pa.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

Cope & Maxwell M'f'g Co.'s Pump adv., page 204.

The Sweetland Chuck. See illus. adv., p. 206.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 205.

Ball's Variable Cut-off Engine. See adv., page 221.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv., page 220.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Paragon School Desk Extension Slides. See adv. p 222.

Blake's Belt Studs. The strongest and best fastening for rubber and leather belts. Greene, Tweed & Co., N.Y.

Brass & Copper in sheets, wire & blanks. See ad. p. 221.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p 222

Gould & Eberhardt's Machinists' Tools. See adv., p. 238.

Granville Hydraulic Elevator Co., 1193 B'way, N. Y.

Heavy Trimmed Walrus Leather, by the Hide or in Wheels, for Polishing Metal. Greene, Tweed & Co., N.Y.

For Shafts, Pulleys, or Hangers. call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Combined Concentric and Eccentric Universal and Independent Jaw Chucks. The Pratt & Whitney Co., Hartford, Conn.

Saw Mill Machinery. Stearns Mfg. Co. See p. 221.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Supplee Steam Engine. See adv. p. 221.

Patent Key Seat Cutter. See last or next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) F. H. W. asks: What are the component parts of Belvedere metal? I judge it is a patent. A. It belongs to what is known as the sulphur sulphides—prepared by fusing certain metallic sulphides (as pyrites marcasite) or chalcopyrite with a suitable quantity of sulphur. See Spence metal, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 222.

(2) G. M. S. writes: I have a standard saw mill, 66 inches bottom, 30 inches top saw, 26 feet fall, and 25 inch American turbine; speed 250 per minute. Can I, by using one pair of bevel wheels, couple directly to saw mandrel, and run as well as from drum with belt? A. No; the velocity of the wheels would be so great that they would be very noisy and wear out rapidly.

(3) C. F. W. asks: 1. If the exhaust of a five horse power engine be turned into a tank about two-thirds full of water, would it lessen the power of the engine? If so, how much? A. Yes, the increased resistance would be that due to the head of water above the pipe—one pound per square inch to every 26 inches head. 2. Would the steam arising from the surface of the water, in tank, be as great and expensive as the exhaust, even though the water was as warm as steam can heat it? A. The total quantity would be the same, if you make no allowance for that required to keep up the temperature of the water; but escaping from a much larger surface it would appear only as a vapor.

(4) F. C. S. asks: Do you know of anything that will produce a growth of hair on head or face of man? A. Subcutaneous injection of small quantities of the salts of pilocarpine has lately produced some remarkable results in stimulation of and altering the color of hair.

(5) L. M. L. writes: I was greatly interested by an article on "Silk Raising in the South," from the Louisville *Courier Journal*, that appeared in the SCIENTIFIC AMERICAN of the 11th instant. May I ask your advice on the following points? 1. Would you advise a woman with a small sum of money, say four hundred dollars, to buy a small piece of land, plant mulberry trees, and go into the business of silk culture? A. No. At present the business offers inducements only to such as have suitable waste land and spare time which they wish to make productive. 2. Could a person make a living by it? A. No. The silk harvest provides employment but for about six weeks, and the number of worms that one person can care for is too small to make the business largely remunerative. Even in China, where labor is cheapest, the silk harvest is profitable mainly because it fills the space just preceding the tea harvest, when there would otherwise be nothing to do. 3. What latitude or what States are best adapted to the business? A. The mulberry thrives almost everywhere in the United States, and silk worms can be raised wherever the mulberry grows. The season is longest in the Southern States, and three broods of worms a year can be raised there against one brood in New England and two in Pennsylvania. 4. Could it be made profitable by combining with it the cultivation of small fruits and rearing of poultry? A. It might be, though poultry requires most attention about the time of the silk harvest. 5. What place would be suited to make these combined occupations profitable? A. Probably in proximity to city markets, especially where good soil for gardening can be had near cheap land for the poultry and the mulberry bushes. 6. How long does it take the mulberry to grow large enough to afford food for the silk worm? A. Four or five years, from seed; three years, from good cuttings. 7. Could a place be found with the trees already growing on it? A. Probably not, though it would not be hard to find trees enough almost anywhere to experiment with. The Women's Silk Culture Association of Philadelphia sell mulberry cuttings, and also eggs for experimental cultivation. The chief promise of silk culture in this country arises from the circumstance that many women have unoccupied time which might be pleasantly employed in this way. It is a home employment that requires but little outlay, and though the product of individual effort may be small, say from $25 to $100 a season, it will be for the most part clear gain.

(6) D. T. E. asks: 1. How is the fine finish put on gold and silver articles such as on the inside of watch cases, etc.? A. Usually by means of suitably shaped burnishing tools made of bloodstone and hard polished steel. 2. How is the cyanide of gold made, and how is gold solution prepared? A. See electro-gold deposits in SUPPLEMENT, No. 310. 3. What is meant by gold rolled plate, and how is it put on? A. A bar or strip of base alloy has soldered to it a thin sheet or foil of gold, and the bar or strip thus covered is passed repeatedly between heavy rollers until it is spread out into thin sheets or rods, every part of which retains a gold surface plating. During the rolling operation it is necessary to frequently soften the metal by annealing.

(7) G. L. F. asks: 1. Is water-glass known by any other name? I have asked for it, but the druggists don't know what it is. A. Water-glass is generally supplied to the trade under the names of soluble glass or silicate of soda. 2. In using the stereotype composition known as Jamin's cement, I find it adheres very firmly to my plaster of Paris moulds. How am I to avoid it? A. Try oiling the mould slightly.

(8) A. C. asks: Can you suggest some mode to remove from a large pane of glass a film or cloud, which I cannot account for. It is not in the glass, but on the surface. Have tried ammonia and whitening, also rottenstone, but failed to remove. A. Slightly moisten finest rouge with water, and apply with a chamois leather cushion, rubbing it in every direction until the film has disappeared and the glass is glossy.

(9) F. C. writes: I have made a cement of bisulphide of carbon and crude rubber, but cannot get it to stick. What is the matter? A. Gently warm the parts to be joined, smear them with the clear cement, and press the parts strongly together, continuing the pressure until the solvent has escaped. You will then find the pieces firmly cemented. See SUPPLEMENT, No. 158, for receipts for better cements. 2. Please give directions for making a good Galilean telescope and night glass. What should be the diameter and focal length of object glass and eye piece? A. You will find a good paper on telescopes in SUPPLEMENT, Nos. 1 and 252.

(10) J. C. H. asks: What is the best method of copying engravings in ink from paper on glass? A. Try the following method: Flow the glass plate with good photographer's negative varnish thinned down somewhat, and when this has partly dried (so that the varnish will not run into the paper) lay the smoothly printed side down upon the varnished surface, and put it under slight uniformly apportioned pressure for twenty-four hours. Then moisten the back of the paper, and by means of a piece of soft rubber rub off the softened paper. If this is done with care the inked lines will remain attached to the varnished glass surface. As the thin varnish is quite transparent, this is equivalent to transferring the engraving to the glass surface. The transfer is frequently improved in appearance by giving the plate (and transfer) a second coat of the varnish. For lantern purposes it is better to cover the surface bearing the transfer with a second plate of glass, and bind the edges with thin cloth or stout paper.

(11) S. M. S. asks: Could you give me a good formula for producing a fine gloss on photographs? A. The beautiful gloss called enameling is produced as follows: After the prints have been toned, washed, and trimmed in the usual way they are immersed in a warm filtered aqueous solution of gelatin of about the consistence of collodion, to which is after added a small quantity of sugar candy. When the paper has become well impregnated with the liquid the pieces are removed and placed, smooth face downward, upon a plate of glass previously coated with a four per cent normal collodion, and air dried. In placing the print care must be taken to quickly press out all air bubbles. Afterwards a sheet of stout white paper, cut somewhat larger than the prints, is cemented to the back of each photograph to protect the pictures in the event of their spontaneously leaving the glass on drying. The plates are allowed to remain overnight in a dry locality, when the portraits may be separated from the glass by making an incision of the film all around the paper.

(12) J. B. asks: 1. Can you inform me of the chemical composition of the stone called the "Lake George diamond?" A. So called "Lake George diamonds" are commonly small, well formed, clear quartz crystals, backed with or mounted over bits of silver foil. Quartz crystals are native crystallized silicic acid. 2. How does its hardness compare with the diamond? On a scale of 10 the hardness of quartz is 7, of the diamond 10. Do these stones always retain their brilliancy, and are they still found? A. No. Quartz crystals are of very common occurrence in some localities. 4. What are its distinguishing qualities from the genuine stone? A. The chief distinguishing features are the difference in hardness, as above noted, the difference of specific gravity (that of quartz being 2·6 and of the diamond 3·48), and the crystalline structure. Consult Dana's Mineralogy.

(13) G. K. T. writes: While experimenting with electric batteries, I had occasion to use a common flower pot for a porous cup. To fill up the hole in the bottom of the pot, I poured in a small quantity of melted tar. When nearly hard I pressed the tar firmly on the inside and outside of the bottom of the pot, thereby pressing the tar firmly into the hole. After using it in the bichromate of potash battery three weeks, I removed the pot and found the tar drawn into the pot to the extent of half an inch. What caused it? Did not the heat and resistance of the current draw it in? A. The reaction of acid and water is very frequently sufficient to warm a liquid so as to soften tar. When the column of liquid in the outer jar is greater than in the porous cup the pressure is naturally inward. It is very improbable that electricity had anything to do with softening or displacing the tar.

(14) C. B. T. H. writes: There is in this city a company manufacturing wagon, carriage, and sleigh material, etc., running from fifty to sixty wood working machines (saws, planers, stickers, mortisers, etc.). When the machines are all running, the engine will lag with 80 pounds of steam. The engine is 18x28 inches, runs 85 revolutions per minute; common slide valve, cuts off at 22 inches; band wheel 10 feet diameter, weight 3 tons; fly-wheel 14 feet diameter, weight 6 tons. 1. How much power will it take to run such a fly-wheel 85 revolutions per minute? A. All the power required is that necessary to overcome the friction; the wheel consumes no power. 2. Is the fly-wheel a benefit or a damage in this case? A. A benefit. You could not run your machines without it.

(15) A. S. asks: Can you inform us through the columns of your valuable paper of a process for whitening scorched larch? A. It will be necessary to sand paper the wood to remove the film of carbonaceous matter. The stain cannot be otherwise removed.

(16) V. D. G. asks: What is the best facing for heavy castings like plow beams, etc.? A. We believe powdered charcoal is considered the best facing.

(17) W. W. writes: 1. A battery of four boilers, two 15-inch flues in each, have a small steam jet in each flue at the back end to increase the draught. The boilers are 28 feet long and 42 inches diameter; smoke stack 50 inches diameter, and 60 feet high. Would it not be more economical to place a jet in the smoke stack equal in size to the eight in the flues? A. Experience says no. 2. Will not the steam in the flues have a tendency to cool the gases entering the flues? A. No such effect as to be appreciable in practice. 3. The furnace is continuous, or extending the whole width of the four fronts, but the flame and gases naturally take the nearest course, and the bulk goes to the two middle boilers' flues. Would not a thin partition wall between each boiler, extending from the firebridge to the back end, remedy this evil, and by distributing the heat better, generate more steam with the same amount of fuel? A. Yes. 4. The steam from these boilers is used by a rolling mill engine, and although the engine is unusually large, still it seems under its work even with steam at 80 to 90 pounds. The steam course from the boilers to the engine is very crooked, there being no less than six sharp bends and three valves between steam drum and cylinder. Will not the friction on these valves and bends greatly diminish the steam pressure by the time it gets to the cylinder? A. It will; how much will depend upon the size of the pipe in proportion to the demand for steam.

(18) J. J. C. asks: What will take nitrate of silver from woolen cloth? A. Try moistening the part first with a drop of iodine solution, and after a few minutes with an aqueous solution of cyanide of potassium, finally rinsing with plenty of warm water.

(19) N. S. C. asks: 1. Why is a salt water bath used in preparing the material for the gelatine copying pad? A. Salt water boils at a higher temperature than pure water. 2. Sometimes the material of my pad peels off and adheres to the paper while I am printing. How can this be prevented? A. Use a larger proportion of glue in the composition, or add to it a small quantity of soap.

(20) L. M. C. writes: Please give me best process for determining the CO_2 in baking powders, also alum? A. For best methods of determining carbonic acid and alum in such preparations consult Thorp's "Quantitative Chemical Analysis." See also Mott's "Chemist's Manual."

(21) J. X. N. writes: In looking over my paper I see a question asked by F. M. L: "Has there been any means devised of using as fuel the siftings or dust of coal mines? A. Yes, they are burned successfully on the Pennsylvania Railroad by a patent process." Now, I do not know whether the Pennsylvania Railroad has any dirt-burning locomotives or not, but I hardly think they have. I do know, however, that the Reading Railroad has in the neighborhood of sixty locomotives in daily use in passenger and freight and heavy coal trains, and they are a complete success. I speak from experience, being an engineer, and having one under my control every day. This furnace is the patent of our general manager, Mr. John E. Wooten, and is, in my estimation, one of the greatest things extant. A Mogul locomotive, built by the Baldwin Locomotive Works with Wooten's patent furnace, can leave Richmond with 150 empty coal cars, run 93 miles without cleaning the fire; come down from Palo-Alto, 93 miles, 145 loaded cars, without cleaning the fire, and have any quantity of steam. So I think this speaks for itself.

(22) P. J. M. asks: What heating surface should there be in a feed water heater for a high pressure steam engine, working with 75 pounds steam pressure, and making 100 revolutions per minute—that is to say, the heating surface per actual horse power; and to what degree of heat will such heating surface heat the water? A. There is no established rule for the surface of feed heaters, nor can there be, so long as the difference is so great in quantity of water used in different boilers, varying from 18 to 35 pounds per horse power. The usual proportion is three-quarters to one square foot per horse power; but a larger proportion would be better.

(23) A. C. S. asks: Will you be so kind as to give the preparation of the blue process paper that is used for copying tracings? A. Dissolve in 8 ounces of distilled or pure rain water 1⅛ ounces of pure ammonio-citrate of iron, and in a separate vessel 1¼ ounces of pure ferricyanide of iron (red prussiate) in a similar quantity of water. Mix these solutions and keep in a yellow bottle or in the dark for use. To sensitize the paper moisten it uniformly with this liquid by means of a soft clean sponge, and suspend it in a dark room to dry. When dry it is ready for use. To preserve it for use it must be kept from the light.

(24) A. M. writes: A short time ago I drew some plans on tracing cloth, and colored portions of them on the back with Faber's wax crayons, red, dark blue, light blue, and light yellow. I afterward had occasion to strike off some copies by the "blue process." They gave clear impressions, but where I had used yellow, the copy showed white; where red was used, very pale blue; while the blue crayon appeared to afford no obstacle to the passage of the actinic rays, the proof coming out full deep blue the same as the portions under the clear white cloth. What is the explanation of this? A. As the actinic rays reside mostly in the upper (blue or violet) end of the spectrum, and as yellow and red transparent (or translucent) media intercept the greater portion of the blue or violet rays the cause of the non-printing (or weak printing) is obvious.

(25) C. M. K. asks: Will you please inform me of what the "vitalized air" is composed which dentists use to deaden pain? A. Probably you refer to the anæsthetic laughing gas or nitrous oxide. This gas is an oxide of nitrogen, usually obtained by heating pure ammonium nitrate to the point of decomposition in a retort.

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(26) T. J. J. asks: How can I preserve a boiler when not at work, for instance, one used in the harvest field for thrashing? It is only used a few months in the summer, and perhaps once every month or two during the winter, and the balance of the time it is corroding and wasting away. It is my judgment that a boiler used so will not last as long as if used all the time. Is it so; and if so, how can I treat it? A. To lay up a portable boiler out of use, blow out or otherwise empty the water from the boiler thoroughly while the iron is warm, so it will dry off inside. Take off a hand hole plate, and (if no man-hole plate) take out the safety valve so as to permit a circulation of air through the interior. Take out the grate bars, and thoroughly clean off the ashes and soot from all parts of the furnace walls and the interior of the tubes. Store the boiler in a dry shed or barn, with the chimney stack standing, or in a dry place with an umbrella hood over the top of the stack, so that dry air will draw through the furnace and tubes.

(27) S. P. W. writes: I am in need of information. I wish to find out how to color wood black entirely through—for instance, knife handles. I have tried and failed. I wish to make maple black enough for knife handles, and have the color so that they can be finished to look something like ebony. They are all cut into about the sizes that are required. A. Steep in a strong boiling aqueous solution of logwood extract for several hours, and then for twenty-four hours more in a strong hot solution of sulphate of iron.

(28) J. F. writes: Please advise us if you can name some process whereby we could make our own carbon paper. We use large quantities, and it comes very expensive buying it from stationers. A. Clear lard, 5 ounces; beeswax, 1 ounce; Canada balsam, one-tenth ounce; lampblack, q. s. Melt by aid of heat, and mix. Apply with a flannel dauber, removing as much as possible with clean woolen rags.

(29) L. N. writes: I have a telephone from my house to that of a friend. The diaphragm is made of tough animal tissue, or drumhead. I formerly used a string for the line, but it was constantly getting out of repair, on account of the different conditions of the atmosphere. I tried wire, but it rings so I cannot understand. I stuffed it behind the diaphragm, and inserted a soft substance between the diaphragm and the tin fastening of the wire, and yet it does not work perfectly. I think the diaphragm is too sensitive. What must I do for it? A. Try small wire cable cord.

(30) G. H. writes: I wish to patch a blacksmith's bellows. What is the best cement for gluing such work? A. Use rubber cement. See receipts in SUPPLEMENT, No. 158.

(31) S. A. H. asks: 1. What is the shade of green on inclosed sample, and how can I obtain a shellac lacquer for tin? A. The colorant of the lacquer appears to be Frankfurt or Scheele's green—an aceto-arsenite of copper. When in a fine state of division it mixes readily with shellac lacquer. It can be replaced to advantage by some of the aniline or coal tar greens, soluble in alcoholic liquids. 2. Can gold be deposited in various colors, say green, red, purple, etc., by galvanism? And if so, can the same be done with other metals and their alloys, such as brass, etc.? Please refer me to some work giving practical instruction for obtaining the various colors in this way. A. Yes. See "Electrometallurgy," in SUPPLEMENT, No. 310. Few of the brighter colors can be obtained with the baser alloys. 3. What is the best lacquer, and how applied, to give articles of brass, such as mountings for optical instruments, etc., the appearance of gold? A. The lacquer to be used depends somewhat upon the color of the brass: for a light brass a dark lacquer is required, and *vice versa*. The following are good receipts for some of these lacquers: 1. Seedlac, dragon's blood, annatto, and gamboge, each 4 ounces; saffron, 1 ounce; wine spirit, 10 pints. 2. Turmeric, 1 pound; annatto, 2 ounces; shellac and gum juniper, each 12 ounces; wine spirit, 12 ounces. 3. Gamboge, ½ ounce; aloes, 1½ ounce; shellac, 8 ounces; wine spirit, 1 gallon. For other formula, see page 209, vol. xliv. See that the finished articles are clear, heat them as hot as the hand will bear, and distribute the lacquer quickly with brush or rag at one operation over the surface. When the articles are small they require to be heated in an oven to harden the lacquer. Several coatings of a thin lacquer give the best results. 4. How is the lacquer made and applied on the gilt moulding known as lacquer moulding, the leaf used in making it being tin foil? A. The lacquer ordinarily employed is composed of an alcoholic shellac solution colored with turmeric and annatto. 5. Is sheet zinc as pure as the commercial (cast) zinc found in the market in the shape of slabs and pigs; or is the sheet alloyed with lead or other metal; and if so, in what proportion? A. No; it usually contains small quantities of antimony and lead. 6. When impure zinc is used for a gravity battery, may the difficulty be overcome same as in the Grove battery, by keeping the zincs amalgamated, or will the mercury be likely to drop from the zinc on to the copper and interfere with the action? A. Amalgamation of the zinc is useless in the sulphate of copper gravity form of battery.

(32) G. C. W. writes: In your last issue you gave recipes to oxidize gold, silver, and brass. Will the same method do for iron? If not, what will; or can iron not be oxidized at all (malleable iron)? A. Iron is much more easily oxidized than the nobler metals. Plunge the clean metal for a few moments into a strong aqueous solution of ferric chloride, then rinse in water. The color may be somewhat improved by heating it in clay to low redness.

(33) W. K. asks: How can I dissolve bronze powder so that I can put it on papier mache with a brush like varnish or paint, and after, when it is dry, can it be burnished with an agate stone, so that it looks like a gilt moulding? A. Mix the powder with thin glue size as a vehicle, this will form a good burnishing varnish. These powders cannot be dissolved and retain their properties.

(34) A. O. writes: This is a world of troubles, and I suppose you are entitled to your share. Here is one of my wife's making. She made, last spring, about ten gallons of parsnip wine, the product of parsnips, sugar and dough of yeast cakes, spread on toast; usually after having gone through fermentation this wine gets perfectly clear, but this time it got cloudy, and so far we have not been able to clear it, although we have tried charcoal, raisins, and bicarbonate of soda. Can you recommend a remedy? A. Try the addition of a small quantity of egg albumen—white of egg—allowing the liquid to remain quiescent for forty-eight hours. Then rack off from the sediment and cap.

(35) M. A. asks: Can you tell me how to color feathers? Is aniline used? A. Use any of the soluble aniline or coal tar dyes of suitable color, usually a quarter of an ounce to the gallon of liquid (water, or water and alcohol) is sufficient. Steam the feathers or put them through boiling water before immersing in the dye beck. Usually no mordant or developer is required except for the reds or pinks. For these chloride of tin and tartaric acid may be employed as brighteners, alone or in connection with soap.

(36) T. N. writes: I have been using a 4 gallon gold solution about eighteen months. For the last two months the anodes coat over with gold. I am using one electrotype copper anode and one gold, and I do not understand why they coat over. I am using a wooden vessel, coated inside and outside with asphalt. The work plates all right. A. Your solution is probably deficient in cyanide. See "Gold Deposits," in SUPPLEMENT, No. 310.

(37) J. S. J. asks: Please give me information how to construct a small nickel plater, for plating small articles, the plates to cost as little as possible; also, information to remove rust from brass, and a polish for polishing brass and steel. A. You will find practical receipts and directions on these subjects in SUPPLEMENT, No. 310.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Wm. F.—It is genuine nutmeg, of poor quality.—J. B.—It is pyrogallic acid.

NEW BOOKS AND PUBLICATIONS.

INCANDESCENT ELECTRIC LIGHTS. New York: D. Van Nostrand. 50 cents.

No. 57 of Van Nostrand's Science Series: contains Du Moncel's and Preece's account of the incandescent electric lights (particularly Edison's) exhibited at the Paris Electrical Exhibition; with papers on the economy of this mode of lighting, by John W. Howell, and on the steadiness of the electric current, by C. W. Siemens.

A NEW METHOD OF SIGNALING ON RAILWAYS. By Sir David Solomons. Tunbridge Wells, Eng.: A. Baldwin.

Describes with some minuteness the electrical signals for railways patented by the author in 1874, with the improvements since made.

ONE OF CLEOPATRA'S NIGHTS, AND OTHER FANTASTIC ROMANCES. By Theophile Gautier. Faithfully translated by Lafcadio Hearn. New York: R. Worthington.

The translator has done his work rather better than such work is usually done. And the same may be said of the publisher. Admirers of Gautier will be pleased to see his artistic and fantastic, not to say erotic, stories in so fine an English dress.

HUBBARD'S NEWSPAPER AND BANK DIRECTORY OF THE WORLD. 2 vols. 8vo, pp. 1228 and 2591. New Haven: H. P. Hubbard. $10. 1882.

These volumes give a vast amount of information with regard to the world's thirty-five thousand periodical publications, and the people who make and read them, together with a directory to some 20,000 American and foreign banking houses, a large number of maps, advertisements, and much statistical matter. Aside from its value to advertisers and in spite of the temporary business utility of much of the information given, the work has, as a whole, a permanent value in that it gives for the first time an elaborate census of the world's periodical literature, and thus exhibits a fairly accurate picture of one phase of human progress. The index of names fills some two hundred closely printed columns.

THE APPLEDORE COOK BOOK. New Edition. By M. Parloa. Boston: Andrew F. Graves. $1.25.

Miss Parloa is well known in this city and elsewhere as a skillful cook and successful teacher of the art of cooking. Both qualifications are shown in the "Appledore." The numerous recipes are plainly and tersely put; and the author claims to have tested and approved them all.

REPORT TO THE STATE BOARD OF HEALTH ON METHODS OF SEWERAGE FOR CITIES AND VILLAGES IN THE STATE OF NEW YORK. By James T. Gardner. Albany: Weed, Parsons & Co. Paper, pp. 15.

Recommends the separate system of sewers for large towns with proper water supplies, and dry removal for villages, hamlets, and isolated dwellings.

ARTISTIC HOMES IN CITY AND COUNTRY. By Albert W. Fuller. Boston: James R. Osgood & Co.

A selection of sketches, showing plans and perspective views of a number of artistic villas, cottages, city homes, a church, with some interior views and explanations.

THE STRUCTURE OF THE COTTON FIBER IN ITS RELATION TO TECHNICAL APPLICATIONS. By F. H. Bowman. Second Edition. New York: John Wiley & Sons.

The first edition of this uncommonly worthy treatise was reviewed at considerable length in this paper a few months ago. The author makes the gratifying announcement in the preface to this edition that he will soon have ready a corresponding treatise on wool.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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March 21, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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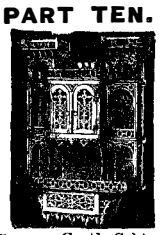
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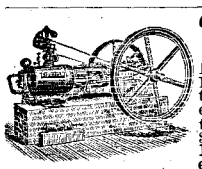
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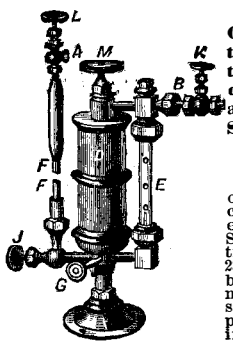

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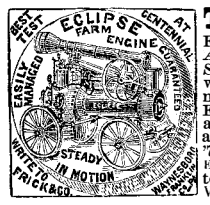

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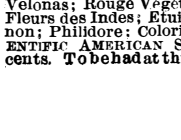

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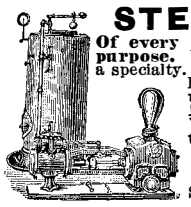
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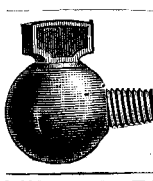
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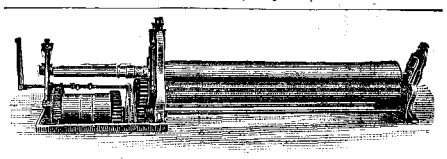
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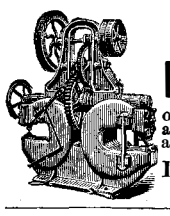
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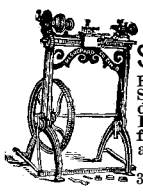
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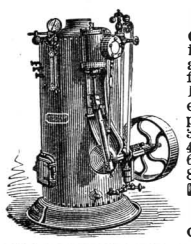

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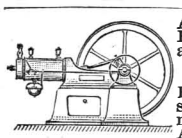

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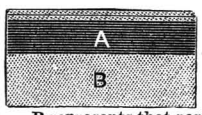

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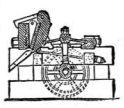

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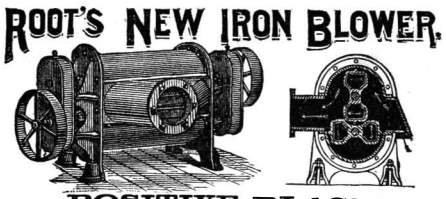

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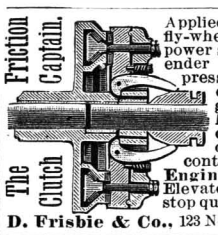

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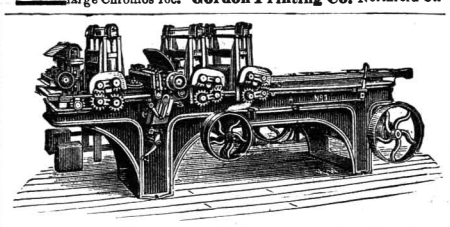

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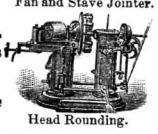

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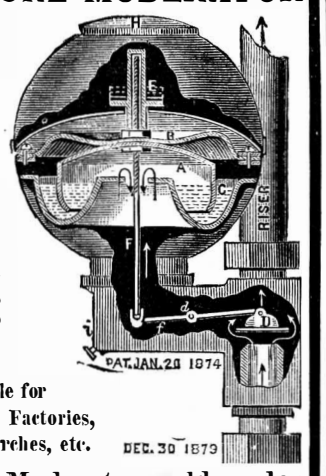

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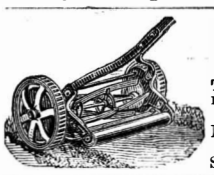

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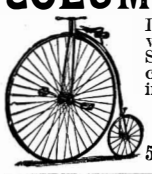

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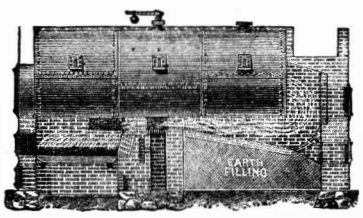

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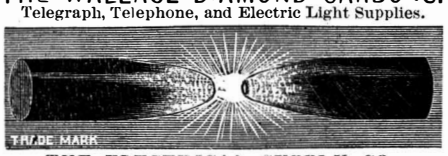

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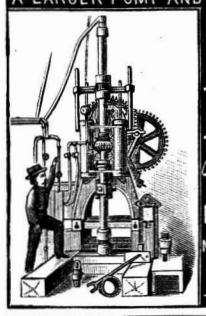

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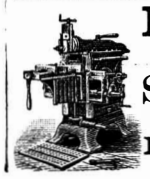

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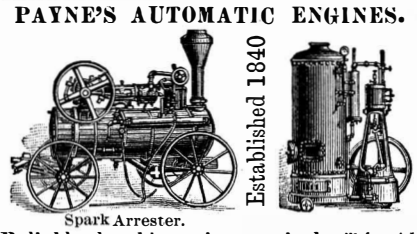

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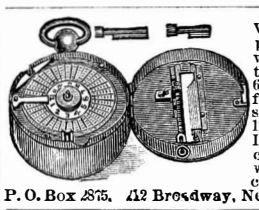

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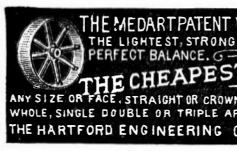
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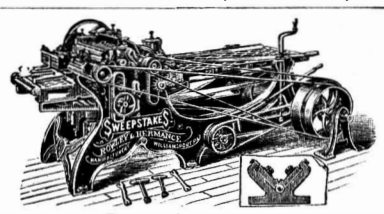

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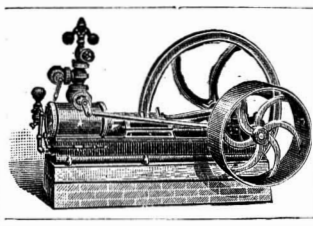

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